

A REVISION OF THE NORTH AMERICAN
FLIES BELONGING TO THE GENUS
APIOCERA (DIPTERA, APIOCERIDAE)

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ABSTRACT

The present revision covers all the known species of flies belonging to the genus *Apiocera* from Canada, United States, and Mexico. The internal structures of the male terminalia are used for the first time in this genus and a standardized nomenclature is proposed for the various structures. Keys for the identification of males and females are presented as are formal descriptions of 35 new species, six new subspecies, and 23 previously described species for a total of 64 taxa. Included are 13 distributional maps of all the known species, two figures of *in situ* male and female specimens, eight figures showing habitats and drinking sites, one figure showing a completely opened and labeled male terminalia, one figure showing labeled structures of the thoracic area,

84 figures of genital and other structures, and 21 figures of abdominal maculation patterns. The following new species are described: *Apiocera wilcoxi*, *foleyi*, *horticolis*, *barri*, *ogradyi*, *chrysolasia*, *volucra*, *bibula*, *parahydra*, *mortensoni*, *fallax*, *acuticauda*, *sylvestris*, *rubrifasciata*, *draperae*, *hamata*, *minckleyi*, *franckei*, *bigelowi*, *femorialis*, *rockefelleri*, *fisheri*, *chiltonae*, *powelli*, *arnaudi*, *caboae*, *auripilosa*, *calida*, *arena*, *macswaini*, *spectabilis*, *voragocolis*, *canuta*, *pruinosa*, *davidsonorum*. The following new subspecies are described: *Apiocera ammophila ammophila*, *ammophila hurdi*, *linsleyi linsleyi*, *linsleyi obliqua*, *haruspex oncorhachis*, *haruspex atrifasciata*.

INTRODUCTION

Historical account: The first species in the genus *Apiocera* was described by Wiedemann in 1830 and was incorrectly placed in the asilid genus *Laphria* as *L. brevicornis*. Macquart (1840) without seeing a specimen of *L. brevicornis* erected a new genus, *Tapinocera*, for Wiedemann's *L. brevicornis* based on the fact that its description indicated that it did not belong to the genus *Laphria*. When Macquart eventually obtained specimens of his *Tapinocera* (= *Laphria brevicornis* Wiedemann) he failed to recognize them and in 1846 redescribed them as *Pomacera* and erected the family Pomaceridae for them. However, Westwood (1835) had already described the genus *Apiocera* for two new Australian species. Bigot in 1857 recognized the group as of family rank, as had Macquart, placing them in his "Asilides," discarding Macquart's *Pomacera* (1846) for *Apiocera* Westwood (1835). *Tapinocera* (1840), based on *Laphria brevicornis*, is therefore also a synonym of *Apiocera* Westwood (1835). The Australian *Apiocera fuscicollis* Westwood (1835) is the type species of the genus *Apiocera* by subsequent designation by Coquillett (1910). Bigot (1857) established the family Apioceridae (*Apios*, a pear; *cerata*, horn, descriptive of the third antennal segment) for these species. The family name was subsequently emended by

Brues and Melander (1932) to the more correct grammatical form, Apioceratidae, a change which has not received general approval as it is not in agreement with article 32 of the International Code of Zoological Nomenclature. Until the publication by Hardy (1933) on the Australian Diptera there was no further information on Wiedemann's *A. brevicornis* and Hardy believed that it should be synonymized under *A. fuscicollis*. However, Paramonov (1953) in his review of the Australian Apioceridae recognized *A. brevicornis* Wiedemann, characterized it and gave distributional records for the species (Paramonov, 1953, pp. 504–505). According to Paramonov, Wiedemann's type specimen is missing from the Berlin Museum.

The known apiocerid fauna of North America began with the description of *Apiocera haruspex* by Osten Sacken in 1877 and he added a second species 10 years later with the description of *augur* in 1887. The known fauna remained at two species for the next 45 years until Painter described *bilineata* in 1932. This was followed in 1936 with Painter's review of the family Apioceratidae in North America in which he added the following nine new species; *interrupta*, *aldrichi*, *caloris*, *trimaculata*, *convergens*, *clavator*, *martinorum*, *beameri*, *notata* and presented the first keys to the North American species.



FIGS. 1-2. *Apiocera painteri*. 1. Male. 2. Female.

Under the tutelage, stimulation, and encouragement of Dr. Painter, Cazier in 1941 added eight new species, reviewed the family Apioceratidae and revised the genus *Apiocera*. The new additions were *pearcei*, *hispida*, *alleni*, *parkeri*, *exta*, *intonsa*, *infinita*, and *melanura*. In 1954 Cazier added two more species, *sonorae* and *mexicana* and in 1963 described *painteri* and gave information on its bionomics, the first for any North American species of *Apiocera*. Prior to the present paper there were 23 known species in North America. In 1975 Lavigne redescribed *clavator*, a little known Mexican species, and gave much valuable bionomic information.

Distribution: At the present time the family Apioceridae is composed of five genera distributed as follows: *Megascelis* Philippi (1865), Chile; *Rhaphiomidas* Osten Sacken (1877), western North America; *Neorhaphiomidas* Norris (1936), southwestern Australia; *Tongamyia* Stuckenberg (1966), southern Africa; and *Apiocera* Westwood (1835), discontinuous north and south temperate areas of world generally. As indicated above, the genus *Apiocera* is the most widely distributed of all five genera, occurring in the southern extremities of the Oriental Region (two species), Ethiopian Region (three species), Neotropical Region (four species), all of the Australian Region (64 species), and the southwestern Nearctic Region (64 species and subspecies). The north-south range is from about 50 degrees north latitude in British Columbia, Canada to about 40 degrees south latitude in Tasmania and Chile. There are only a few species that are known to inhabit tropical and subtropical regions within these latitudinal limits.

In North America the northernmost records are for the only Canadian species, *barri*, a new species, which occurs in the southern portion of the Okanagan Valley in British Columbia in the vicinity of Oliver and Osoyoos Lake. This same species extends southward through Washington, Idaho, Oregon, and into southern California (map 2). The southernmost records are of *mexicana* Cazier which is known from the Mexican states of Guerrero on the western coast and Veracruz on the eastern coast (map 8). This

species extends northward through the state of Tamaulipas into Texas and along the coast to Matagorda, Matagorda County, Texas, which is the northeasternmost record for the genus (map 8).

As would be expected, the species and subspecies are not evenly distributed among the states comprising the area. As mentioned previously British Columbia, Canada, has only one species and Washington has only the same one, *barri*. Colorado also has only a single species in its southwestern section. This is *auripilosa*, new species. Idaho and Oregon share the same species and subspecies, *barri* and *haruspex martinorum* Painter, whereas the only two representatives in Utah are *parahydra*, new species, and *mortensoni*, new species. The other *Apiocera* impoverished states are Nevada with two subspecies and three species, New Mexico with four species, and Texas with six species. With the exception of the Texas *draperae*, new species, none of the above states have any endemic species or subspecies. The maximum number of species and subspecies are found in California, primarily in the southern half, where 26 species and four subspecies are found and 15 of these are endemic to the state. Mexico is a close second in *Apiocera* productivity with 24 species and two subspecies. Prior to the present paper Baja California, Mexico, had only one species recorded from the extreme northern section. Baja California Norte now has nine species of which four are endemic and Baja California Sur has four species and two subspecies of which five are endemic. They occur the entire length of the peninsula. In the Mexican state of Sonora there are five species, in Chihuahua three species, in Coahuila two endemic species, Sinaloa, Jalisco, and Colima share two endemic species, and in Guerrero, Veracruz, and Tamaulipas only *mexicana* is known to occur. Arizona has 17 species and one subspecies of which eight are endemic, ranking it second to California in terms of total numbers and numbers of endemics per state.

Altitudinally the species are found between about 250 feet below sea level to 9500 feet above sea level with the great majority

in the lower range of 1000 to 5000 feet: *haruspex haruspex* Osten Sacken appears to have the highest altitudinal range as it occurs in the Sierra Nevada Mountains of California between 1800 and about 9500 feet: *hispidus* Cazier and *aldrichi* Painter occur at the lowest possible elevation in this hemisphere, the former species occurring in the bottom of Death Valley at about 250 feet below sea level and the latter south of Salton Sea at about 100 feet below sea level. Several species occur at or near sea level, e.g., *mexicana* in Veracruz, Mexico, and at Matagorda, Texas; *linsleyi linsleyi*, new subspecies, at La Paz, Baja California Sur, Mexico; *rubrifasciata*, new species, at 24 miles south of San Felipe, Baja California Norte, Mexico; *barri* at Antioch, Contra Costa County, California. The eight species that occur along the Colorado River from San Luis, Sonora, Mexico to the vicinity of Needles, San Bernardino County, California are at altitudes from near zero to only 481 feet.

Ecology: Most of the information available consists of limited observations on the breeding, drinking, resting, and feeding sites in which these flies are found. For all but 14 species and one subspecies some information has been gathered in the above categories in the natural habitats and many observations have been made in artificial, man-made, situations.

The primary requisite in the breeding sites appears to be suitable edaphic conditions which have to be suitable for egg laying. Secondly, they evidently require at least sparse plant cover for oviposition and protection, and thirdly a nearby source of water. In the breeding site of *painteri* Cazier (1963), mating and egg laying took place in a sandy soil near the base of plants. This observation seems to be characteristic of most of the species as they are found in habitats with this combination of features all together or at least in close proximity to each other. Evidently the female has to insert her abdomen almost completely into the substrate before eggs are laid (Painter, 1932; Cazier, 1963), and since she has only the rosette of acanthopores surrounding the genital opening and an extensible abdomen, to aid in digging,

the substrate has to be soft. Although no additional observations on egg laying have been made since those of Cazier (1963) many hundreds of these flies have been collected in or near situations which seem to have the correct combination of factors.

Sand dunes, whether unconsolidated (fig. 5), partially (fig. 6) or almost completely consolidated (fig. 4), are favored by many species and the flies are especially abundant around the sparsely vegetated edges, e.g., *haruspex martinorum* (fig. 5), *bilineata* Painter, *rockefelleri*, new species, and *sonorae* Cazier. Sands of various colors are utilized as follows: pink, *auripilosa*; white, *melanura* Cazier; red, *mortensoni*; tan, *draperae*; gray, *haruspex martinorum* (fig. 5). Several different mixtures of soil types are found in the habitats of various species, e.g., sandy loam, *rockefelleri*; fine-grained alluvial soil, *parahydra*; sandy alkali soil, *infinita* Cazier. At high altitudes *haruspex haruspex* has been found on sandy loam hillsides away from water and *auripilosa* was collected on a hard rocky loam soil adjacent to a semiconsolidated dune area (fig. 9). Similarly, *draperae* was taken on a gravel bar along a river; *franckei*, new species, on a rocky area and hard clay soil; *femoralis*, new species, on a rocky slope of gray limestone; and *linsleyi obliqua*, new subspecies, on rocks, leaves, and twigs on hard soil. However, all such unsuitable substrate areas were adjacent to deposits of sand which probably served for egg laying. Other types of sandy habitats frequented by these flies are the sand deposits along rivers, streams, small creeks, around springs and lakes (fig. 3), along canals and ditches, and the ocean shoreline. A few species frequently found in such situations included the following: *aldrichi* (fig. 6) and *clavator* Painter, along streams; *bigelowi*, new species, and *minckleyi*, new species, along canals; *notata* Painter and *horticolis*, new species, at mud-hole in stream bed; *mexicana* and *rubrifasciata*, along the seashore.

In each of the above types of sandy habitats vegetation of various kinds and quantities was present. If the observations on *painteri* apply to other species, this vegeta-

tion serves in two primary capacities, i.e., for egg laying and protection, the latter including protection from the heat. In *painteri* the eggs were laid near the base of plants belonging to genera such as *Salsola*, *Verbesina*, *Parthenium*, and *Solanum* which serve as shade cover and may also be involved in the food supply for the larvae. However, the larval food supply is unknown in the entire genus. The comparatively few plants that have been identified in the *Apiocera* habitats belong to 21 families and 38 genera ranging through the plant kingdom from the Pinaceae to the Compositae. Within each habitat no observable preference for a particular plant species was detected, selection by the fly appeared to be by availability, especially for shade and rest.

In at least one general entomological text, these flies are referred to as being "flower-loving flies," a misnomer that conveys the false impression that they are frequently found on flowers where they may be feeding on pollen and nectar. In the many hundreds of specimens collected by the writer and his associates in habitats replete with flowers, not one single specimen of *Apiocera* was collected on a flower. However, in other material examined one specimen of *trimaculata* Painter bears a label stating it was collected on *Melilotus*, sweet clover, a specimen of *calida*, new species, had a few cream-colored pollen grains on its legs and ventral surface, and one specimen of *macswaini*, new species, had several *Asclepias* sp. pollenia adhering to its tarsi, indicating a visit to a milkweed flower. It is doubtful that these few records suggest more than casual visits to flowers even though the flies are evidently attracted to sweet odors. Painter (1932) also noted that lack of visits to flowers. The mouthparts of *Apiocera* are similar to those of the housefly in that they have a prominent fleshy labium terminating in a pair of corrugated sponging organs representing the labella. This muscoid sponging type of mouthpart is unsuitable for penetrating the nectaries of flowers or for consuming pollen grains. They are more suitable for taking in liquids and dissolved substances by capillary action on the labella. Such an assumption seems to

be supported by the fact that the flies drink water and sponge honey-dew from beneath aphid infested plants, the latter being the only known food source of adult *Apiocera*. This honey-dew feeding behavior was observed by James O'Grady under *Atriplex polycarpa* (Torrey) Watson by *ogradyi*, new species, by the author under *Cirsium* sp. by *parahydra* and under an undetermined small tree species by *haruspex martinorum*. *Apiocera pearcei* Cazier has been found in numbers in an apiary, probably being attracted by the sweet smelling honey.

As mentioned above the adult *Apiocera* drink water and are attracted to it, a feature that has been exploited in collecting the flies in some dry desert areas. Lavigne (1975) suggested that these flies are scavengers based on their behavior pattern of placing their sponging mouthparts on the soil. To date, there is little to support such a suggestion, even though it may be true, but we know for a certainty that they feed on insect honey-dew and on water. They may be getting some nourishment in the water, as suggested by Lavigne (1975), but this would seem to be incidental since they have been seen sponging it up on such surfaces as sand, soil, twigs, rocks, and concrete freshly splashed with well-water and therefore too new to have absorbed any nourishment from the substrate. In their natural habitats containing available water, i.e., in streams, lakes, and springs the flies visit the damp sand or soil placing the labella on the surface for from several seconds to several minutes at a time. If disturbed they usually change positions and continue drinking until their thirst is satisfied and they depart. Like many other insects and animals living in hot dry desert areas, these flies are opportunistic when it comes to satisfying their moisture requirements and frequently exploit temporary and artificial water sources, a behavioral trait with considerable survival value. This is especially true when there is little or no water in their breeding habitat or when the nearest source is some distance away. Such adaptability would also be of value in the range expansion of a species.

There are many examples of the exploita-

tion by species of *Apiocera* of man-made alterations in the environment. In Death Valley *hispida* occurs naturally in dunes around a lake at Saratoga Springs but down in the hotter and dryer parts of the valley at Bennetts and Midway Wells there are hand-operated water pumps where water is splashed around accidentally, or on purpose, and the flies come in from the surrounding dry dunes to drink. Scattered throughout the rangeland areas there are cattle-watering troughs with windmills and cattle-watering earthen tanks with or without windmills that serve as drinking sites for flies. Series of specimens of *volucra*, new species, *auripilosa* and *spectabilis* (fig. 10), new species, and others were collected on moist dirt around concrete troughs from which water had been splashed. The margins and muddy bottoms of cattle-watering tanks have been productive of, e.g., *rockefelleri* and *painteri* (fig. 8). Leaky water faucets and pipes in new real estate developments, construction sites, campgrounds, rodeo grounds, and picnic areas create moist areas attractive to *pearcei*, *pruinosa*, new species, *arena*, new species, *mortensoni*, *caloris* Painter, and *minckleyi*. Moist banks of ditches, backyard gardens, and canals are drinking sites of such species as *sylvestris*, new species, *horticolis*, *infinita*, and *parkeri* Cazier. On the southwestern edge of a large unconsolidated dune field near Plano in southeastern Idaho a very large population of *haruspex martinorum* was found in wet sand and soil created by an extensive overflow from an irrigation ditch in a large potato planting. The same subspecies was very abundant in southwestern Idaho in a natural habitat at Bruneau dunes where a lake was the water source (fig. 5). *A. trimaculata* has been found in an irrigated grape vineyard, whereas *pearcei* has been collected around irrigated palm trees, and both *barri* and *aldrichi* have been found drowned in swimming pools, probably falling in while trying to drink.

Other artificial habitats in which the flies have been found include race tracks and black topped roads through and near semi-consolidated dune fields, for *barri* and *parahydra*. In garbage dumps in dune areas,

e.g., *infinita* and *aldrichi*; on black and gray ashes from a brush and palm fire, for *alleni* Cazier and *spectabilis*; on dusty dirt roads and in open sandy vacant lots in a residential area, e.g., *chiltonae*, new species, on dusty dirt roads bordering scattered buildings (fig. 7) and abandoned cultivated fields on the edge of the city limits, e.g., *linsleyi linsleyi*; in dirt car tracks on the edge of a dune area for *auripilosa*. *A. linsleyi linsleyi* has been taken at ultra violet light and *franckei* was collected at the white lights of a motor home. Few specimens were involved. In contrast, many specimens of *volucra*, *acuticauda*, new species, *arena*, and *spectabilis* have been captured in malaise traps and a moderate number of *pearcei* and *caloris* have been captured and observed coming into the white, yellow, bronze, and black surfaces of various motor vehicles. On three occasions specimens that landed on the chrome front bumper of a power wagon and on the white enamel front surface of a motor home were seen to touch mashed dried insect remains with their labella. No specimens spent more than a second or two at this activity as the surface was very hot and the insect remains were hard and dry.

General behavior: Most of the North American species of *Apiocera* occur in arid or semiarid regions where they are exposed at times to high temperatures and to fluctuations in temperatures that necessitate some protection. Limited protection is undoubtedly afforded by their hairiness which traps an insulating layer of air on the body surface, e.g., *hispida*, or by their waxy pruinosity which would prevent water loss and increase reflectivity due to its light color. In some cases, the darker species, e.g., *haruspex haruspex* and *mexicana* occur in less xeric habitats, whereas light-colored, densely pruinose species are found in extremely xeric areas, e.g., *sonorae* and *interrupta* Painter. There are, however, many exceptions to the above, indicating that there are more important and more consistent protective features operating in these flies. Such a feature would appear to be in their heat avoidance behavior which is similar in most species observed by the author and also in the information re-

corded by others, e.g., Lavigne (1975) and Painter (1932).

Every insect species has a fairly well defined range of temperature tolerances within which it is able to survive. Unfortunately, there is no available objective data on such tolerance for any species of *Apiocera*. However, observational data on many species by a number of authors and collectors indicates clearly that these flies change their behavioral patterns as temperatures fluctuate in their arid and semiarid habitats. No doubt the tolerance ranges vary from species to species, between different physiological states within a species and between the four stages in the life cycle of these flies. Even subjective data on the eggs, larvae, and pupal stages of *Apiocera* are lacking except that they are beneath the ground surface and therefore not exposed to more extreme surface temperatures and fluctuations. Behavioral data is available for the adult stage only.

The only observations on possible "sleeping" behavior in *Apiocera* were made by Lavigne (1975) on *clavator* near El Centinela, Colima, Mexico. He describes this behavior as follows: "When the soil surface temperature dropped to ca. 32°C (90°F), usually between 5 and 6 pm, activity would cease. The flies took a position broadside to the setting sun and pressed their bodies against the soil, much in the manner of asilids of the genus *Efferia*. While no observations were made, it is presumed that this is where the apiocerids spent the night." Such an assumption seems to be more likely than my supposition that they spend the night on vegetation, based on observations of their occupying such situations in mid- and late-afternoon. As insolation begins to weaken during the afternoon and there is less heat from radiation as the sun goes down, air temperatures drop rapidly, and perches on plants would be uncomfortable for these poikilotherms. On the other hand, after the sun sets the warmed ground or sand surface continues to gradually give up its heat into the atmosphere by reradiation, and since it is no longer receiving heat from the sun its temperature declines gradually during the night, making it easier for the flies to adjust. Even

though this nocturnal loss of heat is accelerated by the cooling effect of evaporation from the ground, until its temperature is below air temperatures, the changes are gradual and less rigorous in their effect on the flies. The fact that they orient broadside to the setting sun is of little consequence but that this position puts them broadside to the rising sun could be of considerable importance.

As the sun rises the ground surface begins to gain more heat than it loses by reradiation and the temperature rises progressively and rapidly. The flies by having a maximum of surface exposed to the sun as well as to reradiation from the ground surface, would heat up rapidly to their minimum temperature threshold of activity and be able to avoid or escape predation and begin their daily activities. For the first few hours, until about 11 or 12 o'clock, the flies can be found making short flights or standing, walking, or running on the open sand or soil in what appears to be a hunting attitude in the males and a less active waiting attitude in the females. Aside from an occasional visit to the drinking site or when the females are laying eggs, this seems to be the activity pattern until the ground surface temperatures in exposed areas become too hot. By midday or early afternoon high ground surface temperatures are reached as radiation gains are approximately equaled by losses due to reradiation and conduction. At this point ground temperatures would exceed 50°C. (122°F.), the upper limit of most biologic activity when heat destruction of vital proteins takes place. According to Lavigne (1975) ground temperatures at midday were 55°C. (130°F.) when the behavior of *clavator* changed.

Coincidentally with the onset of lethal ground surface temperatures the flies utilize the shade of plants to escape the heat, making swift runs or rapid running flights between shaded areas. Visits to drinking sites in open areas are made during this period of maximum heat but the flies usually land on moist surfaces which would be cooled by evaporation. When even the shaded areas become too hot through heat conduction on the surface and heat convection immediately

above the surface, the flies perch up in the plants where much lower (20°–30°C.) temperatures and higher humidities are found. McSwain found that *macswaini* specimens in open areas were difficult to catch, whereas, those in the shade, either on the ground or on the plants, could be picked off by hand. This is a rather extreme modification in behavior in response to temperature. As the sun sets and radiation decreases, the flies evidently move to the ground and the daily cycle begins again.

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SYSTEMATICS

GENUS *APIOCERA* WESTWOOD

Apiocera Westwood, 1835, p. 448. Osten Sacken, 1877, pp. 283–284; 1878, p. 85. Coquillett, 1885, pp. 243–244. Osten Sacken, 1902, pp. 212–213. Coquillett, 1910, p. 499. Painter, 1932, pp. 350–357. Painter, 1936, pp. 187–203. Cazier, 1941, pp. 589–631. Cazier, 1954, pp. 1–10. Cazier, 1963, pp. 205–234. Lavigne, 1975, pp. 673–676.

DIAGNOSIS: The adults are medium-sized, narrow, large-headed, macrochaetose, pilose and pruinose flies. The male terminalia are external and prominent and strongly resemble those in some asilids. The head is not deeply cleft between the compound eyes, the mouthparts are of the sponging haustellate type and the wings have R_4 , R_5 and M_1 veins curved anteriorly, terminating on the costal margin. M_2 terminates on the posterior margin and the discal cell is short.

DESCRIPTION: Head with compound eyes narrowly or widely separated from lateral ocelli on vertex; ocelli three in number; antennae three segmented; palpi prominent, two segmented; mouthparts short, labella enlarged. Thorax well developed, macrochaetose, pilose and pruinose. Scutellum well developed, macrochaetose, pilose and pruinose. Abdomen gradually tapering apically, maculated, macrochaetose, pilose and pruinose in varying degrees. Legs long, slender, not fitted for grasping, empodia lacking. Termi-

nalium prominent and variable, see special section.

GENOTYPE: *Apiocera fuscicollis* Westwood, Coquillett designation 1910. Type locality: Australia.

RELATIONSHIP: *Apiocera* can be distinguished from *Rhaphiomidas*, the only other genus of North American Apioceridae, by its relatively small size, narrow form, sponging mouthparts, two segmented palpi, wing venation, by the absence of conical swellings on the lateral lobes of the postnotum and by its more complex male terminalia. Because of the increased use and importance of the terminalia structures in the present classification, especially the internal parts, the following special section is included.

MATERIALS AND METHODS

In 1954 the author made an exploratory examination of the structures in the interior of the "box-like" (Cole, 1927) terminalia of several species of North American *Apiocera* (Cazier, 1954). Both group and specific differences in these structures were found, but the paucity of material and the almost complete ruination of dissected specimens delayed a comprehensive study of these structures and a review of the genus. In the intervening 26 years, thousands of fresh

specimens representing many new species and long series of most have been collected. Field dissections of many male terminalia of each species were made without the necessity of relaxing the specimens, a procedure that often mats the pilosity and results in discoloration. Furthermore, in specimens dissected within an hour or two of being collected, the muscles connecting the various structures are preserved in place (fig. 11), and the articulation and the relative position of the parts can be studied.

In fresh material opening the terminalia poses no problem. The specimen is mounted and pinned into a thick (1 inch) styrofoam block so that the venter of the specimen is on the styrofoam surface. Brace pins are placed on each side of the abdomen just anterior to the base of the terminalia. The various parts can then be teased apart and braced for drying as discussed below under dried specimens.

Unfortunately, dried specimens pose quite a difficult problem in opening the terminalia without destroying these hairy maculated flies. Also, unfortunately, there are a large number of dried specimens already in collections, representatives of which had to be dissected and there are old type specimens, some of which had to have the terminalia opened. A number of different techniques have been tried over the years with varying degrees of success but the one described below has worked well for the author in the present study even though it involves breaking the abdomen.

If you have a choice of specimens to be dissected, select individuals in which the wings and legs are away from the sides of the abdomen, especially away from the apical segments. In the majority of species, abdominal segments five through eight have few characters of any value but even so the following, if done carefully, does not destroy the markings or pilosity which are occasionally of use. Turning your forceps sideways, place the lower prong beneath abdominal segment four and bring the upper prong gently down on top of segment five, applying a little pressure until the apical segments break off between segments four and five.

Place each abdominal tip in its own small plastic cup filled with warm water which is then put into an individual styrofoam bottomed unit. Push the tip of the abdomen downward beneath the water surface to break the surface tension and pin the rest of the specimen in the unit alongside the soaking abdominal tip and allow it to soak for 24–36 hours. This long period is necessary to adequately soften the large basal muscles inside the terminalia but there are individual and species differences in the amount of time required, information which can only be gained by trial.

Prepare individual styrofoam pinning blocks for each of the specimens being relaxed. A convenient size for maneuverability on the stage of a dissecting microscope was found to be 3 by 4 inches by 1 inch in depth to allow for firm anchorage of brace pins without their penetrating the bottom of the block. Doing one at a time, remove the soaked tip of an abdomen, place it on a block so the terminalia is facing you. Drive an insect pin at a forward angle through the open end of the abdominal segment down through the venter of the segment, not through the dorsum. This will prevent movement toward or away from you. Cross two insect pins, one from each side, over the top of the abdomen just anterior to the base of the terminalia, pressing down on the segment to prevent lateral movement. This will momentarily distort the segment. With the specimen so anchored and under 20–30 times magnification, take an insect pin in each hand and coming in from each side tease one hemitergite outward, disengaging the locking fold on the inner hemitergite surface from the dorsal margin of the underlying dististyle (fig. 11). If the hemitergite resists outward movement, hold it out as far as possible with one pin without breaking it while a second pin is inserted under it near its base and into the large muscle. Pick away at the muscle with the pin point or pull the point across the muscle until it breaks or pulls away from its attachment with the hemitergite. Follow the same procedure on the other side.

Before anchoring the hemitergites outward at a 90 degree or greater angle from the long

axis of the terminalia, take two pins and insert them subapically between the dististyles and pull or force these structures laterally a small amount until the interbasal folds are exposed. Leave them anchored in this position and then brace the hemitergites outward as indicated above and anchor them in this position (fig. 11). When you look down into the opened terminalia the membranous anal tube can be seen extending posteriorly on top of the proctiger. A pin inserted laterally near the base of the tube and its junction with the proctiger will force the tube upward and anteriorly where it can be anchored out of the way. At this point all the internal structures are easily visible.

In some species the pile on the inner dorsal surface of the claspettes and their ventral subapical lobes may be obscuring a clear view of the apical and lateral structures on the proctiger, structures which are usually important in classification. In figure 11 the membrane attaching the base of the claspette to the side of the proctiger is visible. Break this membrane on one side so that the claspette moves away from the proctiger. The other side can usually be left attached to show its position relative to the proctiger. The membrane can usually be severed by putting a pin through it and applying pressure posteriorly. However, in some cases it is tough and has to be cut with fine-pointed scissors. At this point all structures in the genital cavity used in this paper are easily visible. Before setting the specimen and spread terminalia aside for two to three hours for drying, remove the cross pins on the apical abdominal segment which will allow the segment to assume its natural round shape and facilitate its being glued back on the specimen. If it remains out of shape after the pins are removed, turn the pins around and with one in each hand place the pin heads on each side of the segments and push gently inward and tease them back into their round shape.

After two to three hours, gently remove the brace pins from the terminalia and push the abdominal segments downward and off the pin that was inserted through the open end. Turn the mounted part of the specimen

so that the open end of the abdomen is upward and using the head of a pin place a small drop of glue (Elmer's or white glue or equivalent) in the open end, enough so it protrudes slightly outward. Cradle the terminalia between the two prongs of the forceps exerting just enough pressure to hold it firmly. Turn the mounted portion of the specimen so the body is horizontal and press the abdominal end of the terminalia firmly into the glue on the end of the abdomen. The specimen can be oriented so the terminalia will assume the correct position until the glue dries in a minute or two.

A relatively small number of specimens will become greasy no matter how much care is exercised in collecting, killing, and preparing the specimens for study. Most of these can be degreased with solvents, such as white gas. In order to avoid blurring the print or distortion of the labels beneath the specimens, use a wide mouth relatively shallow (6 cm.), black-topped jar that has a cardboard or rubber lining in the top. Pin the specimens in the top and put just enough white gas in the jar so that when the top is screwed onto the jar the liquid will cover the specimens but not the labels. Most specimens will be degreased if left in the white gas for 24 hours.

TERMINALIA NOMENCLATURE AND MORPHOLOGY

Apiocera and *Rhaphiomidas* the only two genera of North American flies belonging to the family Apioceridae in which the male genital and excretory organs are housed in a greatly enlarged boxlike (Cole, 1927) structure at the terminus of the abdomen, the ninth segment. American dipterists refer to this structure and all it contains as the terminalia (hypopygium of Europeans) and in the Apioceridae only the external features have been previously used in taxonomic studies. Unfortunately, the individual parts often have been referred to by different names. It is generally recognized that the external structures of the terminalia enclose what is known as the genital chamber or cavity and the anal opening (fig. 11).

In the present context I am not concerned with the attempts by morphologists to homologize the various parts of the male terminalia between various genera of Diptera or between various orders of insects. Rather, the important thing here is to standardize the terminology from a taxonomic viewpoint, using what names of homologous structures apply, adopting appropriate terms already in use in *Apiocera* and to propose terms for those unnamed variations in the basic organization of the male reproductive and adjacent structures. The internal features of the male terminalia have never before been used in the classification of the genus *Apiocera* and some of the terminology is herein applied for the first time in this genus. Most of the terms have already been used in other insects by other authors, but except for several structures illustrated by Cole (1927) for *Apiocera* no previous studies of these organs have been published for this genus.

Hemitergites: The dorsolateral covering of the terminalia arising as lateral posterior projections of the ninth tergite are recognized as *hemitergites* following Freeborn (1924) and Cole (1927, 1969). In most *Apiocera* literature, to date, these hemitergites have been referred to as "lateral lobes of the ninth tergite" and since the latter expression is merely a description of a hemitergite, this term is herein adopted for these paired structures (fig. 11). Taxonomically the pilosity and pruinosity of the exterior surface are of value in specific identification as in *caloris* Painter and *pearcei*. The extent of the emargination in the dorsal margin is characteristic of *aldrichi* (fig. 36), and the extent or lack of the subapical emargination and subapical notch are often of value in *notata*, *convergens* Painter and *horticolis* (fig. 33). Although not used in the present paper, the overall shape of the hemitergites differs between some species, e.g., between *haruspex haruspex* (fig. 33), *barri* (fig. 35), and *sonorae* (fig. 34). In most species the ventroposterior margins are evenly rounded but in *powelli*, new species; *minckleyi* and *clavator*, this margin is deeply emarginate, a feature unique to these species (fig. 37). The inner hemitergite surface features will be discussed later.

Dististyles: The ventrolateral structures covering this portion of the terminalia are lateral projections of the ninth sternite and are termed dististyles (figs. 44, 45, 11). This term has been in common usage in Diptera and in *Apiocera* for a number of years, e.g., Cazier (1941, 1963), Cole (1927, 1969), Tuxen (1970); and it appears to be the best term for these structures which are used extensively in this treatment. The term originated with Crampton (1923) who proposed basistylus for the base of the structure and dististylus for the apical portion. This assumes two segments which in *Apiocera* are not evident and consequently the term dististyle is used for the entire structure which has internal lobes. In some species, e.g., *foleyi*, new species; *ogradyi*; *haruspex haruspex* and 22 other species there is a single postmedian incision in the inner dististyle margin (figs. 31, 32, 44, 45) which may indicate the division between Crampton's basistylus and dististylus. However, in *hamata*, new species; *augur* Osten Sacken and 32 other species there is no incision in the inner dististyle margin (figs. 46–49) and therefore no reason taxonomically to recognize two divisions of this structure. Cole (1927), in his illustration of *haruspex*, refers to the basal portion as the gonostipes and the area posterior to the postmedian marginal incision as the dististylus. Such a division, as indicated above, has little or no taxonomic value in *Apiocera*.

In addition to dividing the genus almost into equal parts based on the presence or absence of the postmedian marginal incision, the dististyles are distinctive in several other ways. The shape and extent of the incisions vary between species, e.g., in *foleyi*, the incision is indistinct, in *infinita* the incisions are very narrow (fig. 29), whereas in *melanura* they are wide (fig. 27). In *augur* the outer subapical margin is shallowly emarginate (fig. 46), a feature characteristic only of this species. In *clavator* the dististyles are turned sharply inward subapically, a unique character for this species (fig. 17). In *wilcoxi*, new species, the incisions, instead of being transverse, extend obliquely inward and posteriorly from the margin (fig. 31). The dististyles vary in shape from being wide, short,

and bluntly rounded apically as in *haruspex haruspex* (fig. 45) to being elongate, narrow and gradually attenuated apically into a sharp point as in *acuticauda* (fig. 44). The pilosity, pruinosity, and color are frequently used in the separation of species. Whether or not the margins posterior to the postmedian incisions are opposed (fig. 14) or separated (fig. 13), is correlated with the presence or absence of incisions, thus dividing the genus into almost equal parts. In most species the dististyles are evenly sparsely pilose; however, in four species the apex is clothed with a dense brush of long hairs (comate), as in *draparae*, *mexicana* (fig. 28), *intonsa* Cazier, and *interrupta*. No other species have this character.

Posterior projection of the ninth abdominal sternite: The terminalia enclosure is completed ventrally by this posterior projection, the median extension of which is used at both group and specific levels. This structure has been referred to by various taxonomic authors as the median (or posterior) projection of the ninth abdominal sternite and has been used extensively; see Freeborn (1924), Cole (1927), Tuxen (1970), Cazier (1941, 1964), and Lavigne (1975). Along with the postmedian incision in the inner dististyle margins, the long recumbent pile on the median projection has been used to divide the genus almost into two equal parts. The structure itself is narrow and rounded dorsally and usually obscured by the pile as in *mortensoni* and *haruspex haruspex* (fig. 14). In *sonorae* and *bilineata*, the long recumbent hairs are sparse and lateral so that the median portion of the posterior projection can be seen. In those species without the long recumbent pile, the median posterior projection may be convex as in *hamata* (fig. 18) and *franckei*; or flat and parchment-like, as in *pearcei* and *parkeri* (fig. 22). The surface also may be tumid as in *canuta*, new species, and *pruinosa* (fig. 19). It may also vary in the size and extent of the parchment-like lateral and apical extensions, and in the arrangement and color of the pile. The posterior margin of the median projection is deeply biemarginate in *powelli* (fig. 20), a feature unique to this species. *A. alleni* can be sepa-

rated from all other species by having the median projection extending posteriorly to or beyond the interbasal folds, the tips of which extend into the ventral opening between the dististyles (fig. 23).

Inner hemitergite surface: Most of the structures enclosed by the hemitergites, dististyles and the median posterior projection of the ninth sternite are replete with folds, lobes, emarginations, projections, and extensions that are herein described and delineated for the first time and which are of great importance in species and group determinations. Also, the inner surface of the hemitergites have several important structural features. The most obvious of these is a subapical fold that protrudes outward and downward from the hemitergite surface in varying degrees and which slips over the dorsal subapical dististyle margin when the terminalia are closed, locking the two structures together. This is being called the locking fold, instead of the inner apical fold of the ninth abdominal tergite as referred to by Cazier (1954). Although not used in the present classification, the locking fold varies in the angle of protrusion from the surface, shape and size and may eventually be found to be definitive. However, in *barri*, the locking fold extends to or beyond the ventral and posterior hemitergite margins, a feature not shared with most species (fig. 35). In most species the surface is bare or minutely fuzzy in appearance, however, in eight species the surface is densely clothed with short bristle-like hairs as in *mexicana* and *sonorae* (fig. 34). The area, along the attachment of the base of the locking fold with the hemitergite surface, may be devoid of pile as in *foleyi*, or there may be a tuft of black, erect, bristle-like hairs as in *chrysolasia*, new species, and there is a sparse row of bristle-like hairs in this area extending to the dorsal margin of the hemitergite. Just beneath the shallow or deep emargination in the dorsal hemitergite margin there is a tuberculate area (fig. 35) of varying shape and extent that may prove to be of taxonomic value; however, it has not been used in the present treatment although it exists in all known species. In all but one species the large basal hemitergite muscle

attachment is confined to the basal third or basal half of the hemitergite, e.g., in *sonorae* (fig. 34). In *clavator* this muscle attachment extends along the ventral half of the hemitergite from the base almost to the emargination in the posterior margin, a character definitive only of this species (fig. 37). This feature not only complicates the spreading of the terminalia but more importantly probably indicates a different position and posture during copulation.

Inner dististyle surface: The inner surface of the dististyles is shallowly concave especially toward the base and offers few distinctive features. However, in several species the posterior margin of the postmedian transverse incision is turned inward in varying degrees and has a sharp median toothlike projection, e.g., *sonorae*, *mexicana*, *melanura*, *rubrifasciata* (fig. 30), and *bilineata*. The concavity in the dististyle surface and the turned in posterior margin of the incision form a cradle for the closely attached interbasal folds.

Interbasal folds: The interbasal folds of Freeborn (1924), Cazier (1941), Cole (1969), and Tuxen (1970) are prominent in all known North American species and are contoured to fit against or very close to the inside concave dististyle surface. In 25 species the folds are bifurcate apically, e.g., *aldrichi* and *pearcei*, into an outer branch, against the dististyles, and an inner branch, facing the claspettes (see fig. 11). In 34 species the lobes are undivided apically and only the inner portion is visible, e.g., *pearcei* and *calida* (figs. 42, 43). The apex of the outer branch may extend into the ventral opening between the dististyles as in *beameri* Painter and *alleni* (see figs. 46–49) or it does not reach the opening as in *caboae*, new species, and *exta* Cazier. The dorsal and apical margins of the inner interbasal folds may be bi-emarginate as in *horticolis* and *mortensoni* (see fig. 38) or with a single emargination as in *sonorae* (fig. 40) and *femoralis* or it may lack emarginations as in *powelli* and *chiltonae* (fig. 41). In most species these emarginations are transverse, rounded or oblong (fig. 47) but in 12 species they extend diagonally inward and anteriorly from the mar-

gin, e.g., *davidsonorum*, new species, and *painteri* (see fig. 46). Both outer and inner interbasal folds may have their apices pointed as in *beameri* and *hamata* (see figs. 47, 48) or bluntly rounded as in *hispida* and *voragocolis*, new species (see fig. 49) or truncate and thickened along the edge as in *auripilosa* and *spectabilis* (fig. 11). Among the species with a single dorsal emargination there are several that have the basal margin greatly enlarged and membranous as in *draperae* and *sonorae* (fig. 40). In seven species this posterior margin is strongly clavate but not membranous in *bilineata* and *augur* (fig. 46).

Claspettes: The paired structures on either side of the median proctiger are herein termed claspettes, a term previously used by Freeborn (1924), Cole (1969), and Tuxen (1970). These are segmented and are articulated by the transverse muscle connecting the interbasal folds with the ventrolateral portions of the proctiger. The claspettes display a number of important characters and extend from near the base of the interbasal folds slightly diagonally inward to beyond the apex of the proctiger (see fig. 11). In most species they are clothed with varying amounts of pilosity which may function in a sensory capacity during copulation. In 10 species, e.g., in *hamata* (fig. 62) and *rockefelleri* the claspettes are dorsoventrally arcuate from near the base to the apex. The remainder of the species lack the arcuation and are either straight medially as in *rubrifasciata* and *macswaini* (see figs. 59, 60) or slightly bowed laterally as in *bigelowi* (fig. 65). The dorsal margins, whether arcuate or straight, are completely or partially membranous as in *minckleyi* or *chiltonae* (fig. 64), or without membrane as in *bigelowi* (fig. 65) and *aldrichi*. This same dorsal margin may be densely pilose as in *haruspex haruspex* (fig. 53) and *acuticauda* or sparsely to moderately pilose as in *barri* (fig. 55) and *draperae* or devoid of pile as in *beameri* and *hispida* (see figs. 63, 64). The midventral margin in two species, *notata* (figs. 58, 61) and *convergens*, have a few long golden hairs that extend downward and inward beneath the proctiger and aedeagus. In most

species these median hairs are short and arranged in a fan-shaped group as in *chrysolasia* and *ogradyi* (see fig. 57). In 13 species the short hairs are near the base and are arranged in a line along the ventral margin as in *parkeri* and *spectabilis*. In 20 species there are only a few scattered hairs along the ventral margin or none at all, as in *painteri* and *arnaudi*, new species. The claspettes may lack an apical lobe and terminate in a slightly to moderately enlarged rounded tip as in *wilcoxi* (fig. 54) and *bibula*, new species, or the rounded apex may angle outward from the rest of the surface forming a liplike undifferentiated short extension, as in *chiltonae* (fig. 64) and *bigelowi* (fig. 65). A well-differentiated, ventrally elbowed apical lobe is present in 23 species including *arena* and *pruinosa* (see figs. 66, 67). In 24 species the ventral subapical lobes of the claspettes are long and sinuous (figs. 11, 54) and extend from the subapical ventral surface of the claspettes inward and downward to the vicinity of the aedeagus and posteriorly beyond the apex of the proctiger where their tips usually meet or overlap. The lobes are moderately densely clothed throughout with erect fine hairs that are probably sensory in function during the process of copulation, e.g., in *wilcoxi* (fig. 54) and *caloris*. In the remainder of the species the ventral subapical lobes vary from being short and inconspicuous to medium in length as in *horticolis* (fig. 56) and *volucra*. They can be medium in length and slender as in *interrupta* (fig. 60) and *sonorae* or medium to short in length and thickened basally as in *hamata*, *hispida*, and *frankei* (see figs. 63–65). In *barri* the lobe has only a basal tuft of long hair on its outer margin (fig. 55), whereas in *parahydra*, *haruspex haruspex* (fig. 53), and 13 other species the entire outer margin is clothed with long curved evenly spaced usually black pile. In *bilineata*, *rubrifasciata*, and 30 other species the lobe has only a few scattered medium or long hairs (see figs. 57, 54) and in *intonsa* (fig. 59) and *infinita* there are no long hairs on this structure.

Proctiger: Of all the structures of the male terminalia, both internal and external, the proctiger exhibits the greatest amount of

variability and the most distinctive features for groups of species or single species. This name was used for the central unpaired structure by Freeborn (1924), Cole (1969), and Tuxen (1970). It encloses the needle-shaped aedeagus on all sides, its base is rigid where it connects with the dorsally located membranous anal tube, and it is attached laterally near its base to the claspettes and the interbasal folds (fig. 11). A number of its apical features appear to be involved in the guidance and support of the aedeagus in some but not all species. However, the basal close association between the proctiger and aedeagus appear to be constant for all North American species in the genus. In only six known species is the apical third of the proctiger bent sharply upward, 45–90 degrees, beginning at the narrow constriction in the dorsal ridge. The upturned portion can be divided or continuous, spined or not spined, with or without a round smooth elevated central area, or with or without lateral arm-like projections, depending on the species. The six species unique in this structure are *femoralis* (fig. 84); *rockefelleri*; *augur*; *fisheri*, new species; *chiltonae* (fig. 86); and *linsleyi linsleyi* (fig. 85). In the remainder of the species the apical third is horizontal as a continuation of the basal two-thirds, e.g., *mortensoni* and *haruspex haruspex* (see figs. 75–82). The apex of the proctiger is uniquely structured in *foleyi* into a deeply divided inverted Y-shaped termination (fig. 72) and in *bigelowi* the end is broadly expanded into an inverted U-shape (fig. 83). In four species *aldrichi*, *arnaudi*, *beameri*, and *hispida* there are paired falciform sharp-pointed horizontal blades protruding posteriorly from beneath the apex and above the aedeagus, a character unique in these species (fig. 87). In most species there is no tubular collar anterior to the apex of the proctiger, e.g., *barri* and *calida* (see figs. 90, 91); however, in *aleni*, *pearcei*, and three others, there is an elongate cylindrical collar between the lateral shieldlike projections and the apex (see fig. 89). In *clavator*, *caboae* (fig. 96), and five others the collar is short (figs. 92, 93). In 26 species, including *powelli* (fig. 88) and *auripilosa*, there are lateral shieldlike projections

that extend outward and downward anteriorly (see figs. 87, 89–93). These vary in position relative to the main shaft of the proctiger and as to shape, size, and spinosity. The apex of the proctiger is divided apically into long lateral hornlike projections, a feature shared only by *hamata*, *minckleyi*, and *franckei* (figs. 80–82). In 10 species, including *notata* and *linsleyi linsleyi* (fig. 85) there are no lateral projections of any kind, whereas in *sonorae* and *intonsa* the short lateral projections are broad and membranous and in *fallax*, new species (fig. 77), and *chrysolasia* (fig. 79) they are of varying lengths but not membranous nor narrow and hornlike. In 14 species there are vertical spines usually near or on the apex, e.g., *fallax* (fig. 77) and *franckei* (fig. 81). None of the other species have dorsal projections, e.g., *infinita* and *trimaculata* (see figs. 89–93). The dorsal apex of the proctiger in 11 species has a middorsal apical opening formed laterally by the lateral projections whose posterior margin forms the posterior, partially closed, opening (see figs. 75–79). This opening may be rounded or oblong as in *chrysolasia* (fig. 79) and *volucra* (fig. 76). The opening when formed by the lateral posterior projections is narrow and elongate as in *notata*, *parahydra* (fig. 74) and 16 other species. In most species there is no middorsal apical opening as in *painteri* and *macswaini* (see figs. 90–96). In 26 species there are projections of various shapes and at various angles that extend posteriorly beyond the middorsal apical opening as in *acuticauda* and *sylvestris* (see figs. 73, 74). In *bilineata*, *caboae*, and in 13 other species there is no vertical spine at the base of these posterior projections. In *parahydra* (fig. 74), *mortensoni* and two other species the posterior extensions arise directly from the dorsal spine and in *sylvestris*, *barri*, and five other species the posterior extensions arise from beneath the dorsal spines (see fig. 77). In *melanura*, *intonsa*, and seven other species the posterior projections are a continuation of the lateral margins of the narrow, elongate middorsal opening (see fig. 74) and extend posteriorly and gradually downward with their inner margins close together. In most species there are no posterior pro-

jections beyond the middorsal opening as in *fisheri*, *chiltonae*, and 31 other species (see figs. 75, 76). That portion of the proctiger anterior to the middorsal opening or to the lateral projections has several distinctive features, some of which are more difficult to delimit than are the striking differences in other areas. In 33 species the midline of the dorsal longitudinal ridge is rounded upward, e.g., *hispida* and *arnaudi* (see figs. 87–89). The dorsal surface may be almost flat and the lateral margins gradually diverging from the apex toward the base, e.g., *melanura*, *bilineata*, and 12 other species. In *volucra* (fig. 76), *chrysolasia* (fig. 78) and five other species the lateral margins are explanate anterior to the dorsoapical opening. In the rest of the species, including *wilcoxi* and *ammophila ammophila*, new subspecies, the lateral margins are strongly constricted anterior to the dorsoapical opening (see figs. 86–88). The lateral margins are subparallel medially in *chrysolasia* (fig. 79); *parahydra*, and eight other species, whereas, in the rest of the species they are angulate in this area, e.g., *pearcei* and *calida* (see figs. 86, 88). Among those species that lack the dorsal posterior projections from the apex there are 15 that have ventral projections that extend downward on each side of the aedeagus as in *trimaculata* and *pearcei* (see figs. 94–96).

Aedeagus: This intromittent organ, as it is sometimes called, is the subject of considerable controversy by students of morphology, including Freeborn (1924), Cole (1927, 1969), and Tuxen (1970) who are frequently cited in this paper. However, in the genus *Apiocera*, the visible portion of this genital organ consists of a sclerotized, needle-shaped tube that has no appendages or membranous parts and the term is herein used only for this part of the structure. As indicated in Tuxen (1970) the aedeagus is covered dorsally by the proctiger. In *Apiocera* the aedeagus is completely surrounded by the proctiger and protrudes posteriorly through a membrane-lined opening near the ventral surface. It is also embraced by the lateral shieldlike structures when present, and the dorsal posterior projections that ex-

tend downward on each side of it, as described above in some species. It has been visible in all specimens examined, but has not been used for classification purposes.

Anal tube and anus: The anal tube (fig. 11), a membranous structure of varying lengths is dorsal to the proctiger extending through the large basal muscle that articulates the hemitergites and is attached to the proctiger behind and below this muscle (fig. 11). In most species as in *spectabilis* and *parkeri*, this tube can be seen from above by looking down between the inner hemitergite margins which are not completely apposed even when the terminalia is closed. The anus is located terminally on this tube and is surrounded by sparse, short hair. In some species it appears to be bilobed because of two lateral cerci projecting from the apex, e.g., in *spectabilis*. In species in which there is a subapical emargination in the inner hemitergite margin the anal tube extends to this emargination so that the anus is on the anterior edge of the opening. In *aldrichi* the emargination is deep (fig. 36), whereas in *horticolis*, and *volucra*, it is shallow (see figs. 33, 35) and excretion could probably take place through the emargination without opening the hemitergites. However, in most species there is no dorsal emargination (fig. 34) and the hemitergites would have to be opened for defecation, an opinion that seems to be supported by the lack of any excrement soiling the terminalia in hundreds of specimens examined. Species without the emargination have variable lengths of anal tubes in relation to the hemitergite lengths. In *draperae*, the tube extends a little beyond the middle of the hemitergite. In *intonsa* and *mexicana* about two-thirds the length and in *sonorae* and *bilineata* about three-fourths the hemitergite length. This structure was not used in the present classification and due to its membranous condition it would probably require special preparation for study. According to Cole (1969) "The anal opening is always dorsal in relation to the ventrally located genital openings. The cerci represent the appendages of the eleventh segment of lower insects."

EXPLANATION OF KEYS

An unsuccessful attempt was made to develop a key to the males without having to use the internal structures of the terminalia. The results were long, cumbersome, and largely unsatisfactory as many species appeared in more than one dichotomy. The following key to the males requires the extensive use of the internal terminalia structures and the method of making these visible is described in the preceding section on Materials and Methods. In the present key only two species *arena* and *parkeri* appear in two dichotomies. The key to the females is largely a disaster as they have few distinguishing characters and most of these are variable. However, rather than leave them out, I have attempted to make possible at least a tentative identification of the females. From one to six species appear in each of the dichotomies, which by itself is unsatisfactory. However, in most cases of multiple species per dichotomy, each species will have a different distributional range which will aid in a more positive identification. Rather than complicating the key further, the distributions of the species in which females are known, are given in Appendix 1. These are listed by countries, states, and counties under each specific or subspecific name so that when a specimen keys to a multiple dichotomy the distribution of each of the species can be found and used in separating the species. If by chance the distributions overlap, this key will be of no help to you and a male specimen will be your only salvation.

The order in which the species and subspecies appear in the text follows the order in which they appear in the key to the males. Thus, closely related forms usually appear in close proximity.

KEY TO *APIOCERA* MALES

1. Inner margin of each dististyle with a single postmedian incision, margins apposed or narrowly, irregularly separated ventrally from marginal incisions to near apex (fig. 14); median posterior projection of ninth abdominal sternite with long recumbent pile extending

- posteriorly from basal margin or lateral margins and middorsum to or beyond postmedian dististyle marginal incisions (fig. 14) 2
- Inner margin of each dististyle without a postmedian incision, inner margins not apposed ventrally from the apex of the median projection to near apex (fig. 13); median posterior projection of ninth abdominal sternite without long recumbent pile extending posteriorly from basal or lateral margins (fig. 13) ... 30
2. Claspettes with ventral subapical lobes long and sinuous (fig. 54); postmedian incision in inner dististyle margins deep, extending obliquely inward and posteriorly (fig. 31) 1. *wilcoxi*
- Claspettes with ventral subapical lobes absent, short or medium in length, straight or slightly bent (fig. 53); postmedian incision in inner dististyle margins transverse or nearly absent (fig. 32) 3
3. Locking folds on inner hemitergite surface bare or with a few scattered short hairs or with a tuft of six to 30 hairs midbasally near or on the junction of the locking fold with the hemitergite surface (fig. 33) 4
- Locking folds on inner hemitergite surface with surface densely clothed with short erect bristle-like dark hairs over half or more than half of the surface (fig. 34) 21
4. Proctiger with apex divided into an inverted Y-shape (fig. 72); inner hemitergite surface without prominent hairs; inner dististyle margins with indistinct postmedian incisions 2. *foleyi*
- Proctiger with apex not divided into an inverted Y-shape (fig. 73); inner hemitergite surface with large or small tuft or row of short erect black hairs, usually medially on or near base of locking folds (figs. 33, 35); each inner dististyle margin with a distinct postmedian transverse incision (fig. 32) 5
5. Ventral claspette margin with some of the median golden hairs long, curved downward and inward beneath the proctiger and aedeagus (figs. 58, 61). Viewed from posterior 6
- Ventral claspette margin with all median golden hairs short, arranged fanlike, not extending beneath the proctiger and aedeagus (fig. 57). Viewed laterally ... 7
6. Dark abdominal transverse vittae on segments three and four continuous, not completely interrupted dorsolaterally (fig. 97) 4. *notata*
- Dark abdominal transverse vittae on segment three and/or segment four interrupted dorsolaterally by longitudinal gray or white vittae (fig. 98) 3. *convergens*
- 7(5). Claspettes with ventral subapical lobes short, wide and/or inconspicuous (figs. 53, 56, 59) 8
- Claspettes with ventral subapical lobes of medium length, narrow and conspicuous (figs. 55, 57, 60) 10
8. Proctiger with posterior margins of lateral apical projections evenly rounded outward, downward and anteriorly, margin and surface smooth (fig. 78) 5. *horticolis*
- Proctiger with posterior margins of lateral apical projections irregularly emarginate, margin and surface rough (fig. 79) 9
9. Mesonotal marginal macrochaetae usually black; costal wing vein primarily black pilose basally; posterior head surface usually black and white macrochaetose dorsally 6. *chrysolasia*
- Mesonotal marginal macrochaetae usually white; costal wing vein primarily white pilose basally; posterior head surface white macrochaetose dorsally 7. *ogradyi*
- 10(7). Ventral subapical claspette lobes with long curved, usually black, hair along outer margin (figs. 52, 53, 57); hemitergite locking folds not extending to or beyond ventral or posterior hemitergite margins (fig. 33) 11
- Ventral subapical claspette lobes with only a basal tuft of long hair (fig. 55); hemitergite locking folds extending to or usually beyond ventral and/or posterior hemitergite margins (fig. 35) ... 8. *barri*
11. Proctiger not prominently extending dorsally and posteriorly beyond apices of middorsal apical opening, apices without dorsal acute projections (figs. 75, 76) 12
- Proctiger with prominent posterior extensions beyond apices of middorsal apical

- opening, apices with dorsal projections, usually acute (fig. 77) 13
12. Abdominal transverse dark markings on segments three and four partially or completely interrupted dorsolaterally by white or gray longitudinal vittae (fig. 99); proctiger with dorsolateral margins usually subparallel from base to mid-dorsal apical opening (fig. 75) 9. *bibula*
- Abdominal transverse dark markings on segments three and four not interrupted dorsolaterally (fig. 100); proctiger with dorsolateral margins usually strongly explanate from apical third to base of middorsal apical opening (fig. 76) 10. *volucra*
- 13(11). Proctiger with upper edge of posterior extensions continuous with dorsal spines, extending gradually downward and posteriorly on each side of aedeagus (fig. 74); proctiger with dorsoapical opening narrow and elongate longitudinally (fig. 74); abdominal transverse dark vittae on segments three and four usually partly or entirely infuscated 14
- Proctiger with posterior extensions arising from beneath dorsal spines, sharply biangulate downward and posteriorly (fig. 73); proctiger with dorsoapical opening wide, rounded, or broadly transverse (fig. 73); abdominal transverse dark vittae on segments three and four black or brown, usually not infuscated 15
14. Anterior femora with outer margin entirely or primarily white macrochaetose; abdominal transverse dark vittae on segments three and four usually broadly infuscated basally .. 11. *parahydra*
- Anterior femora with outer margin entirely or primarily black macrochaetose; abdominal transverse dark vittae on segments three and four not or only narrowly infuscated basally 12. *mortensoni*
- 15(13). Proctiger with wide lateral shieldlike extensions arising from basal area of mid-dorsal opening, extending outward at right angles to proctiger, downward and slightly anteriorly, margin deeply serrate dorsally and at ventral angle, shallowly serrate medially (fig. 77) 13. *fallax*
- Proctiger without wide lateral shieldlike extensions arising from the basal area of the middorsal opening 16
16. Dististyles piceous, elongate, gradually attenuated apically, terminating in a sharp point (fig. 44), densely black pilose along midrib in apical third 14. *acuticauda*
- Dististyles dark brown, abruptly or not attenuated, usually terminating in a rounded or blunt apex (fig. 45), sparsely black pilose along midrib in apical third 17
17. Abdominal segment three with apical margin wide white or tan pruinose, not interrupted; claspettes with upper inner margin sparsely golden pilose (fig. 52) 15. *sylvestris*
- Abdominal segment three with apical margin entirely or partially black; claspettes with upper inner margin moderately to densely clothed with golden pile (fig. 53) 18
18. Head with posterior surface entirely or predominantly black macrochaetose in dorsal half ... 16. *haruspex haruspex*
- Head with posterior surface entirely or predominantly white or occasionally brown macrochaetose in dorsal half 19
19. Proctiger with vertical spines at base of posterior lateral arms long and strongly angulate posteriorly in apical third 17. *haruspex oncorhachis*
- Proctiger with vertical spines at base of posterior lateral arms short and straight or occasionally slightly angulate posteriorly at tips (fig. 73) 20
20. Abdominal transverse dark vittae on segments two through four completely or partially interrupted dorsolaterally by longitudinal gray or white pruinose vittae (fig. 101) 18. *haruspex martinorum*
- Abdominal transverse dark vittae on segments two through four usually not interrupted dorsolaterally (fig. 102) 19. *haruspex atrifasciata*
- 21(3). Posterior tarsal pulvilli small, less than half the length of the claws, may be barely visible at base of the claws (figs. 68, 70) 22
- Posterior tarsal pulvilli medium to large, extending to or beyond middle of claws, easily visible (figs. 69, 71) .. 23

22. Dististyles primarily or entirely brown or black pilose medially; abdomen primarily tan pruinose dorsally; legs unicolorous testaceous; posterior tarsal pulvilli evident, not quite half as long as claws (fig. 68) 21. *sonorae*
- Dististyles primarily or entirely white pilose medially; abdomen primarily gray pruinose dorsally; legs with femora piceous, at least in part, tibiae and tarsi testaceous; posterior tarsal pulvilli narrow, about one-third the length of the claws, not evident (fig. 70) 20. *bilineata*
- 23(21). Posterior tarsal pulvilli narrow, about one-half as long as claws (fig. 69) ... 24
- Posterior tarsal pulvilli broad, about two-thirds as long as claws (fig. 71) ... 25
24. Dististyles black and white pilose; femora and tibiae white pilose and macrochaetose; mesonotum white macrochaetose marginally 22. *rubrifasciata*
- Dististyles black pilose; posterior tibiae entirely or primarily black or brown macrochaetose; mesonotum entirely or primarily black macrochaetose marginally (in part) 23. *mexicana*
- 25(3). Dististyles comate, with dense subapical brush of long hair, hairs longer and more closely spaced than those on the remainder of the dististyle (fig. 28) ... 27
- Dististyles not comate, without dense subapical brush of long hair, pilosity of uniform length throughout (fig. 29) 26
26. Inner dististyle margins with narrow postmedian transverse incisions, inner margins of incisions narrowly separated (fig. 29); abdominal segments two through six with the inner margin of the subquadrate dorsolateral longitudinal dark markings nearly straight medially, dorsal and ventral margins subparallel, markings usually broadly continuous between segments (fig. 116) 25. *infinita*
- Inner dististyle margins with wide postmedian transverse incisions, inner margins of incisions widely separated (fig. 27); abdominal segments two through four with the inner margin of the subquadrate dorsolateral longitudinal dark markings convex medially, dorsal and ventral margins not subparallel, markings narrowly constricted between segments (fig. 117) 24. *melanura*
- 27(25). Abdominal segments five through seven with wide red subquadrate dorsolateral longitudinal markings; inner interbasal folds with anterior margin of emargination membranous, broadly expanded apically (fig. 42) 26. *draperae*
- Abdominal segments five through seven without red subquadrate dorsolateral longitudinal markings; inner interbasal folds with anterior margin of emargination not or narrowly membranous laterally, strongly clavate apically (fig. 46) 28
28. Abdominal segments two through four with middorsal dark linear maculations (fig. 115) (in part) 23. *mexicana*
- Abdominal segments two through four without middorsal dark linear maculations 29
29. Dististyles with pile entirely or primarily black or brown; claspettes with ventral subapical lobes absent or medium in length, thin, apical half without short erect hairs (fig. 59) 27. *intonsa*
- Dististyles with pile entirely or primarily white, golden, or light tan medially; claspettes with ventral subapical lobes medium in length, apical half with short erect hairs (fig. 60) ... 28. *interrupta*
- 30(1). Claspettes arcuate dorsoventrally from the base to the apex (fig. 62); medium projection of ninth abdominal sternite usually convex, lateral extensions leathery in appearance, overlapping dististyles laterally for almost its entire length (fig. 18) 31
- Claspettes not arcuate dorsoventrally, occasionally slightly arcuate laterally (fig. 60); median projection of ninth abdominal sternite flat or shallowly curved inward along its margins (fig. 16), lateral extensions membranous or parchment-like, usually not overlapping dististyles laterally for most of its length (fig. 17) 41
31. Proctiger divided apically into long lateral hornlike projections on each side, extending outward at about a 90 degree angle from the longitudinal axis of the proctiger, sharply pointed at the apex (figs. 80, 81, 82) 32
- Proctiger without lateral hornlike apical projections (figs. 84, 85, 86) 34
32. Compound eyes separated from the lateral ocelli on the vertex by one and one-half times the diameter of a lateral ocell-

- lus (fig. 50); proctiger with outer portion of lateral apical projections enclosed with flat sclerotized material extending from near outer tip diagonally across to the proctiger (fig. 82) 29. *hamata*
- Compound eyes separated from the lateral ocelli on the vertex by less than the diameter of a lateral ocellus (fig. 51); outer portion of lateral apical projections not enclosed (figs. 80, 81) ... 33
33. Proctiger with lateral apical projections sharply angulate at inner base, extending laterally at almost right angles to proctiger (fig. 80); dististyles long white pilose; median projection of ninth abdominal sternite primarily white pilose 31. *minckleyi*
- Proctiger with lateral apical projections evenly rounded at inner base, shallowly bent outward at right angles to proctiger (fig. 81); dististyles black pilose; median projection of ninth abdominal sternite primarily black pilose 30. *franckei*
- 34(31). Claspettes with dorsal inner margins without a membranous lining (fig. 65) 35
- Claspettes with dorsal inner margins completely or partially membranous (figs. 63, 64) 37
35. Proctiger broadly emarginate apically, inverted U-shaped, ventral projections of lateral extensions extending downward and shallowly bent anteriorly on each side of the aedeagus, terminal emargination broadly horizontal, not turned upward (fig. 83) 32. *bigelowi*
- Proctiger closed or shallowly divided apically, posterior portion turned sharply upward at narrow subapical constriction, without lateral extensions (fig. 84) 36
36. Abdominal segment five and usually six and seven with prominent dark dorsolateral maculations, segments two through four with large dorsolateral subtriangular black maculations separated or widely connected middorsally (fig. 104) 33. *femorals*
- Abdominal segments five through seven without prominent dark dorsolateral maculations, segments two through four with dorsolateral dark markings not connected middorsally (fig. 105) ... 55. *rockefelleri*
- 37(34). Inner interbasal folds with a narrow deep elongate oblique emargination in subapical dorsal margin (fig. 46); dististyles with dorsal subapical margins shallowly emarginate (fig. 46) 34. *augur*
- Inner interbasal folds without narrow oblique emargination (fig. 47); dististyles with dorsal subapical margin usually straight or convex (fig. 47) ... 38
38. Inner interbasal folds with large deep round emargination in median dorsal margin, marginal opening barely or moderately constricted, margin posterior to emargination curled inward and anteriorly (fig. 47) 35. *fisheri*
- Inner interbasal folds without deep emargination in median dorsal margin, apical margin not curled inward and anteriorly (figs. 48, 49) 39
39. Inner interbasal folds with ventral apex wide, obtusely rounded, prominently extending into the ventral opening between the dististyles (fig. 49); proctiger with rounded smooth vertical apex, not cleft medially or membranous and without vertical projections (fig. 86) 36. *chiltonae*
- Inner interbasal folds with ventral apex elongate narrow acutely pointed, not or barely extending into the ventral opening between the dististyles (fig. 48); proctiger shallowly divided and membranous dorsoapically, apex with sharp lateral vertical apical projections (fig. 85) 40
40. Pronotum, mesonotum, and abdominal dorsum primarily tan pruinose; dorsolateral dark markings on abdominal segments two and three not strongly oblique (fig. 106) ... 37. *linsleyi linsleyi*
- Pronotum, mesonotum, and abdominal dorsum primarily gray pruinose; dorsolateral dark markings on abdominal segments two and three oblique, narrow basal end angled laterally (fig. 107) 38. *linsleyi obliqua*
- 41(30). Median projection of ninth abdominal sternite deeply biemarginate apically (fig. 20); abdominal segment four without dark dorsal markings 44. *powelli*
- Median projection of ninth abdominal sternite not deeply biemarginate apically (figs. 21, 22); abdominal segment four with dark dorsal markings ... 42
42. Hemitergites with posterior margin deeply emarginate (fig. 37); dististyles turned

- sharply inward subapically (fig. 17); hemitergite muscle attachment extending from base nearly to apical emargination (fig. 37) 39. *clavator*
- Hemitergites with posterior margin not deeply emarginate (figs. 33, 34, 36); dististyles almost straight or gradually curved inward in apical third (fig. 16); hemitergite muscle attachment not extending beyond the middle of the hemitergite (fig. 34) 43
43. Proctiger with an apical pair of horizontal dorsoventrally flattened, sickle-shaped (falciform), sharp pointed blades protruding posteriorly from beneath dorsum of lateral shield and above aedeagus, blades narrowly separated basally, apices usually touching or overlapping (fig. 87) 44
- Proctiger without sickle-shaped horizontal posterior blades (figs. 88, 89) .. 47
44. Abdominal segments three and four with dark dorsal markings primarily or entirely black or brown pilose 45
- Abdominal segments three and four with dark dorsal markings primarily or entirely white pilose 46
45. Abdominal tergites two through four with lateral margins white pilose; posterior head surface white macrochaetose dorsally 40. *aldrichi*
- Abdominal tergites two through four with lateral margins black or brown pilose; posterior head surface black and white macrochaetose dorsally ... 41. *arnaudi*
- 46(44). Abdominal dark markings on segments two and three reaching apical margin medially (fig. 113); compound eyes separated from the lateral ocelli on the vertex by less than the width of a lateral ocellus (fig. 51) 43. *beameri*
- Abdominal dark markings on segments two and three not reaching apical margin medially (fig. 114); compound eyes separated from the lateral ocelli on the vertex by the width or more than the width of a lateral ocellus (fig. 50) 42. *hispidia*
- 47(43). Ninth abdominal sternite with median projection narrow elongate, densely black pilose laterally along midrib, extending posteriorly to or beyond posterior margin of outer interbasal folds which extend prominently into the ventral opening between the dististyles (fig. 23) 45. *alleni*
- Ninth abdominal sternite with median projection not narrow and elongate apically, not densely pilose laterally along the midrib, not extending posteriorly to the interbasal folds (figs. 24, 25) .. 48
48. Pteropleura bare anterior to metathoracic spiracles 49
- Pteropleura with sparse to dense long hair anterior to metathoracic spiracles (fig. 12) 50
49. Compound eyes separated from the lateral ocelli on the vertex by the width of a lateral ocellus (fig. 50); costal wing vein entirely or primarily black pilose; proctiger narrow dorsally, lateral margins expanded medially ... 47. *painteri*
- Compound eyes separated from the lateral ocelli on the vertex by less than half the width of a lateral ocellus (fig. 51); costal wing vein white pilose; proctiger broad dorsally, lateral margins parallel medially (fig. 96) 46. *caboae*
- 50(48). Abdominal sternites two through four brown or golden pilose 48. *auripilosa*
- Abdominal sternites two through four white pilose 51
51. Inner interbasal folds without an emargination in the dorsal margin, margin sinuous, apex turned inward (fig. 43); abdominal tergites five through seven primarily black or piceous, usually without pruinosity but occasionally farinose 49. *calida*
- Inner interbasal folds with dorsal margin deeply emarginate apically or subapically (fig. 42); abdominal tergites five through seven white or gray pruinose 52
52. Median projection of ninth abdominal sternite wide and elongate, lateral membranous extensions parchment-like, not tumid, posterior margin angulate laterally, lateral margins usually subparallel medially, broadly overlapping dististyles laterally, median posterior projection short and blunt (fig. 21) 53
- Median projection of ninth abdominal sternite tumid or short, lateral membranous extensions with margins rounded or strongly divergent from base to subapical wide point, narrowly overlapping dististyles at widest point, medium pos-

- terior projection medium to long, usually acute (fig. 22) 56
53. Proctiger with an elongate tubular collar separating the dorsal junction of the margins of the lateral shield from the apex of the proctiger (fig. 89) 54
- Proctiger without a prominent collar, lateral shield margins forming a dorsal junction with the proctiger at or slightly anterior to the apex (fig. 90) 55
54. Hemitergites primarily white pilose externally 51. *caloris*
- Hemitergites primarily or entirely black or brown pilose externally 50. *pearcei*
- 55(53). Costal wing vein white pilose from the base to the apical one-quarter; compound eyes separated from the lateral ocelli on the vertex by more than the diameter of a lateral ocellus (fig. 50); terminalia gray pruinose (in part) 53. *arena*
- Costal wing vein black pilose from the long white basal hairs to the apex; compound eyes separated from the lateral ocelli on the vertex by less than the diameter of a lateral ocellus (fig. 51); terminalia brown pruinose 52. *exta*
- 56(52). Hemitergites and dististyles gray pruinose throughout or in large part on exterior surface 60
- Hemitergites and dististyles without pruinosity or with brown pruinosity on exterior surface 57
57. Costal wing vein primarily white pilose; compound eyes separated from the lateral ocelli on the vertex by the width or more than the width of a lateral ocellus (fig. 50) (in part) 54. *parkeri*
- Costal wing vein black pilose except for the white basal hairs; compound eyes separated from the lateral ocelli on the vertex by less than the width of a lateral ocellus (fig. 51) 58
58. Posterior femora entirely or primarily white pilose; compound eyes separated from the lateral ocelli on the vertex by one-half or slightly more than one-half the width of a lateral ocellus 57. *macswaini*
- Posterior femora entirely or primarily black or brown pilose; compound eyes separated from the lateral ocelli on the vertex by less than one-half the width of a lateral ocellus 59
59. Posterior femora and tibiae, exclusive of the pruinosity, unicolorous piceous, reddish brown or black; proctiger robust, dorsal subapical collar short and broad (fig. 66); inner interbasal folds with dorsal margin deeply emarginate apically (fig. 39); size large 56. *spectabilis*
- Posterior femora black, tibiae reddish brown, exclusive of the pruinosity; proctiger narrow, dorsal subapical collar medium in length and narrow (fig. 67); inner interbasal folds with dorsal margin moderately emarginate apically; size medium 58. *voragocolis*
- 60(56). Compound eyes narrowly separated from the lateral ocelli on the vertex, almost touching; midposterior projection of the ninth abdominal sternite with surface of lateral membranous extensions tumid (fig. 19) 61
- Compound eyes separated from the lateral ocelli on the vertex by the width or more than the width of a lateral ocellus (fig. 50); midposterior projection of ninth abdominal sternite with surface of lateral membranous extensions flat (figs. 21, 22) 62
61. Proctiger broad, dorsal margins subparallel medially (fig. 94); midposterior projection of the ninth abdominal sternite primarily or entirely white pilose; posterior tibiae primarily white pilose 59. *canuta*
- Proctiger medium in width, dorsal margins shallowly angulate postmedially (fig. 95); midposterior projection of the ninth abdominal sternite black or black and white pilose; posterior tibiae primarily brown pilose ... 60. *pruinosa*
- 62(60). Proctiger with an elongate dorsal collar between the lateral shield junction and the apex, lateral margins, anterior to the lateral shield, broadly angulate postmedially (fig. 92); abdominal dark dorsal markings on segments two through four usually divided dorsolaterally by longitudinal gray vittae (fig. 110) 61. *davidsonorum*
- Proctiger without or with short dorsal collar (fig. 93); abdominal dark dorsal markings on segments three and four not divided dorsolaterally (fig. 111) ... 63
63. Posterior femora and tibiae brown pilose, entirely or primarily black macrochaetose 64

- Posterior femora white pilose and macrochaetose, posterior tibiae primarily or entirely white pilose and macrochaetose 65
- 64. Midposterior projection of ninth abdominal sternite with margins of lateral membranous extensions evenly rounded, widest medially (in part) 54. *parkeri*
- Midposterior projection of ninth abdominal sternite with margins of lateral membranous extensions gradually divergent to subapical angles of posterior margin, widest postmedially, usually at subapical angle ... (in part) 53. *arena*
- 65(63). Dististyles primarily or entirely brown or black pilose 63. *ammophila hurdi*
- Dististyles primarily or entirely white pilose 66
- 66. Abdominal segment two with a middorsal diamond-shaped black maculation, not connected laterally to a smaller dorsolateral rounded dark spot (fig. 108); femora and tibiae unicolorous black or piceous 64. *trimaculata*
- Abdominal segment two with a middorsal black maculation connected laterally with a dorsolateral dark spot (fig. 109); legs bicolorous, femora black or piceous, tibiae testaceous or light reddish brown 62. *ammophila ammophila*
- (in part) 55. *rockefelleri*
- (in part) 37. *linsleyi linsleyi*
- (in part) 38. *linsleyi obliqua*
- 4(2). Costal wing vein entirely or primarily black pilose 5
- Costal wing vein entirely or primarily white pilose or black and white pilose with outer row white and sparse, inner row black 6
- 5. Head with dorsal posterior surface and midpronotum with both black or brown and white macrochaetae 3. *convergens*
- Head with dorsal posterior surface and midpronotum white macrochaetose 43. *beameri*
- 6(4). Posterior tarsi with long ventrolateral macrochaetae entirely or primarily black 7
- Posterior tarsi with long ventrolateral macrochaetae entirely or primarily white 8
- 7. Posterior tibiae brown or black macrochaetose 23. *mexicana*
- Posterior tibiae white macrochaetose 26. *draperae*
- 25. *infinita*
- 24. *melanura*
- 8(6). Abdominal segments two and three with dorsolateral dark maculations narrow, dorsal, and ventral margins parallel or subparallel medially 9
- Abdominal segments two and three with dorsolateral dark maculations moderately wide, dorsal, and ventral margins shallowly convex medially, not subparallel 27. *intonsa*
- 9. Mesonotal (fig. 12) discal pile white ... 28. *interrupta*
- Mesonotal (fig. 12) discal pile black or brown 10
- 10. Mesonotum, mesopleura (fig. 12) and abdominal terga on segments one through four primarily or entirely gray pruinose 22. *rubrifasciata*
- Mesonotum, mesopleura (fig. 12), and abdominal terga on segments one through four primarily or entirely tan pruinose (in part) 21. *sonorae*
- 20. *bilineata*
- 11(1). Tarsal pulvilli less than half as long as tarsal claws (fig. 70) 12
- Tarsal pulvilli half or more than half as long as tarsal claws (figs. 68, 69) 13
- 12. Posterior femora entirely or primarily

KEY TO *APIOCERA* FEMALES¹

1. Abdominal dorsolateral dark maculations on segments two and three longitudinal, oblong and usually narrow (fig. 116) ... 2
- Abdominal dorsolateral dark maculations on segments two and three transverse or in variously shaped spots or absent (fig. 104) 11
2. Mesopleura (fig. 12) with disc of dorso-caudal angle pilose and usually macrochaetose 3
- Mesopleura (fig. 12) with disc bare or with a few hairs along the ventral margin .. 4
3. Posterior femoral macrochaetae black 39. *clavator*
- Posterior femoral macrochaetae white 47. *painteri*
- 29. *hamata*

¹ The distributional information in Appendix 1 will aid in the separation of the species where more than two are given in a single dichotomy.

- white macrochaetose .. 36. *chiltonae*
 (in part) 21. *sonorae*
- Posterior femora entirely or primarily brown or black macrochaetose 35. *fisheri*
- 13(11). Pteropleura with sparse to dense long hair anterior to metathoracic spiracles (fig. 12) 14
- Pteropleura usually bare or with a few scattered short hairs anterior to metathoracic spiracles (fig. 12) 27
14. Costal wing vein entirely or predominantly white pilose 15
- Costal wing vein entirely or predominantly black pilose 26
15. Abdominal tergite one entirely or primarily pale golden pilose, especially on lateral angles ... (in part) 48. *auripilosa*
 (in part) 54. *parkeri*
 (in part) 51. *caloris*
- Abdominal tergite one entirely or primarily white pilose 16
16. Posterior tibiae primarily or entirely white macrochaetose 20
- Posterior tibiae primarily or entirely black or brown macrochaetose 17
17. Lateral pronotal angles (humeri) primarily black or brown macrochaetose (fig. 12) 18
- Lateral pronotal angles (humeri) primarily white macrochaetose (fig. 12) 19
18. Dorsocaudal mesopleural angle (fig. 12) bare (in part) 18. *haruspex martinorum*
- Dorsocaudal mesopleural angle (fig. 12) pilose and usually macrochaetose (in part) 50. *pearcei*
 (in part) 54. *parkeri*
 (in part) 51. *caloris*
 (in part) 53. *arena*
 (in part) 48. *auripilosa*
- 19(17). Mesonotal (fig. 12) marginal macrochaetae primarily or entirely white (in part) 42. *hispida*
- Mesonotal (fig. 12) marginal macrochaetae primarily or entirely black (in part) 54. *parkeri*
- 20(16). Abdominal segment one with lateral submarginal macrochaetae black 21
- Abdominal segment one with lateral submarginal macrochaetae entirely or primarily white 22
21. Mesonotal (fig. 12) marginal macrochaetae primarily or entirely white (in part) 42. *hispida*
- Mesonotal (fig. 12) marginal macrochaetae primarily or entirely black (in part) 54. *parkeri*
- 22(20). Mesopleura with disc of dorsocaudal angle (fig. 12) bare (in part) 18. *haruspex martinorum*
- Mesopleura with disc of dorsocaudal angle (fig. 12) pilose and usually macrochaetose 23
23. Mesonotal disc (fig. 12) white pilose (in part) 42. *hispida*
- Mesonotal disc (fig. 12) brown or black pilose 24
24. Posterior tibiae with posterior surface brown and white pilose (in part) 48. *auripilosa*
- Posterior tibiae with posterior surface white pilose 25
25. Posterior femora sparsely pruinose, ground color piceous or testaceous (in part) 53. *arena*
 64. *trimaculata*
 (in part) 51. *caloris*
- Posterior femora densely gray pruinose, obscuring testaceous ground color ... 63. *ammophila hurdi*
 62. *ammophila ammophila*
- 26(14). Mesopleura with disc of dorsocaudal angle (fig. 12) bare, without pile or macrochaetae (in part) 19. *haruspex atrifasciata*
- Mesopleura with disc of dorsocaudal angle (fig. 12) moderately to densely pilose, sparsely macrochaetose 56. *spectabilis*
 40. *aldrichi*
 (in part) 57. *macswaini*
 (in part) 42. *hispida*
 (in part) 50. *pearcei*
 (in part) 51. *caloris*
- 27(13). Posterior tibiae with posterior surface, between rows of macrochaetae, entirely or primarily white pilose 28
- Posterior tibiae with posterior surface, between rows of macrochaetae, entirely or primarily brown or black pilose 35
28. Abdominal segments two and three with discal pile entirely or partially white 29
- Abdominal segments two and three with discal pile entirely brown and black 32
29. Costal wing vein with white pile usually extending from the base to near the apex 30
- Costal wing vein white pilose basally,

- black and white pilose medially, black pilose in apical third 31
30. Abdominal segment one with golden lateral pile, submarginal macrochaetae primarily or entirely white (in part) 48. *auripilosa*
- Abdominal segment one with white lateral pile, submarginal macrochaetae primarily or entirely black (in part) 55. *rockefelleri* (in part) 31. *minckleyi* 11. *parahydra* ... (in part) 18. *haruspex martinorum*
- 31(29). Posterior tarsi with outer surface of segment one primarily white pilose (in part) 18. *haruspex martinorum* (in part) 5. *horticolis*
- Posterior tarsi with outer surface of segment one brown or black pilose 7. *ogradyi*
- 32(28). Scutellar disc primarily brown pilose 33
- Scutellar disc primarily white pilose ... (in part) 55. *rockefelleri* (in part) 30. *franckei* (in part) 31. *minckleyi* (in part) 5. *horticolis*
33. Costal wing vein black pilose or mixed black and white pilose basally (in part) 57. *macswaini*
- Costal wing vein white pilose basally 34
34. Costal wing vein white pilose from base to near apex (in part) 37. *linsleyi linsleyi* (in part) 35. *linsleyi obliqua*
- Costal wing vein black and white pilose from basal long white hairs to apical third of wing, black pilose in apical third (in part) 1. *wilcoxi*
- 35(27). Posterior femora with outer surface entirely or primarily white pilose medially 40
- Posterior femora with outer surface entirely or primarily brown or black pilose medially 36
36. Abdominal segment four with discal pile primarily white (in part) 4. *notata*
- Abdominal segment four with discal pile brown and black 37
37. Anterior femora with inner concave surface entirely or predominantly white pilose 39
- Anterior femora with inner concave surface primarily brown or black pilose 38
38. Posterior femora with outer surface black and white pilose (in part) 14. *acuticauda*
- Posterior femora with outer surface black pilose (in part) 13. *fallax* ... (in part) 19. *haruspex atrifasciata* 16. *haruspex haruspex* 17. *haruspex oncorhachis*
- 39(37). Abdominal segment two with dorsolateral dark markings transverse, elliptical (in part) 14. *acuticauda*
- Abdominal segment two with dorsolateral dark markings subtriangular 6. *chrysolasia* (in part) 4. *notata* (in part) 8. *barri*
- 40(35). Costal wing vein with white pile extending from base to or beyond the middle of the wing 41
- Costal wing vein black pilose or without white pile extending beyond the middle of the wing 44
41. Mesopleura (fig. 12) with disc of dorso-caudal angle bare or sparsely hairy along ventral edge (in part) 1. *wilcoxi* (in part) 30. *franckei* (in part) 55. *rockefelleri*
- Mesopleura (fig. 12) with disc of dorso-caudal angle sparsely to moderately densely pilose, usually macrochaetose 42
42. Head with vertex between the lateral ocelli primarily white pilose (in part) 31. *minckleyi* (in part) 32. *bigelowi* (in part) 30. *franckei* (in part) 48. *auripilosa*
- Head with vertex between the lateral ocelli black pilose 43
43. Abdominal dorsolateral dark markings on segments two and three bare and shiny; outer femoral surface with faint or evident median longitudinal dark stripe (in part) 55. *rockefelleri* (in part) 33. *femoralis*
- Abdominal dorsolateral dark markings on segments two and three absent or pruinose and dull; outer femoral surface without median longitudinal dark stripe (in part) 32. *bigelowi* (in part) 30. *franckei* (in part) 31. *minckleyi* (in part) 38. *linsleyi obliqua*
- 44(40). Head with dorsal posterior surface and/or midpronotum with both black and

- white macrochaetae
 (in part) 8. *barri*
 (in part) 13. *fallax*
 (in part) 10. *volucra*
 (in part) 5. *horticolis*
 (in part) 12. *mortensoni*
 (in part) 9. *bibula*
 (in part) 14. *acuticauda*
 ... (in part) 19. *haruspex atrifasciata*
- Head with dorsal posterior surface and/or
 midpronotum white macrochaetose ..
 45
45. Legs unicolorous testaceous or reddish,
 femora pruinose
 (in part) 12. *mortensoni*
 (in part) 9. *bibula*
 (in part) 15. *sylvestris*
 (in part) 33. *femoralis*
- Legs bicolorous, femora piceous or red-
 dish brown, densely pruinose, tibiae
 testaceous or reddish brown 46
46. Abdominal segments two and three with
 dorsolateral dark maculations with pos-
 terior margin nearly straight, parallel
 with apical margin of segments
 (in part) 10. *volucra*
- Abdominal segments two and three with
 dorsolateral dark maculations with pos-
 terior margin rounded, not parallel with
 apical margin of segments
 (in part) 15. *sylvestris*
 (in part) 57. *macswaini*

No females are known for the following:

A. augur, *arnaudi*, *powelli*, *alleni*, *caboae*,
calida, *exta*, *voragocolis*, *canuta*, *pruinosa*
 and *davidsonorum*.

SYSTEMATIC DESCRIPTIONS

1. *Apiocera wilcoxi*, new species

Figures 31, 54; Map 1

DIAGNOSIS: Medium-sized, narrow; ptero-
 pleura bare, white pruinose in front of meta-
 thoracic spiracles; dististyles closed ventral-
 ly in apical third, without transverse incision
 posterior to or under apex of long dark re-
 cumbent hairs of median projection of ninth
 sternite, with longitudinal slightly angulate
 submarginal notch in this position (fig. 31);
 abdominal segments three and four with
 wide dorsal transverse uninterrupted dark
 bands; long hair on base of costal wing vein
 white; median projection of ninth sternite not
 overlapping dististyles laterally, posterior
 margin and median point with long recum-
 bent black hairs extending apically beyond
 middle of dististyles and covering median
 opening between dististyles.

DESCRIPTION: Male: Head with front
 white pruinose and pilose, vertex between
 and behind ocelli brown pilose; antennal seg-
 ments one and two white pruinose, pilose
 and macrochaetose, segment three bare,
 gray and brown pruinose, dark, ending in
 short acute tooth; palpi white pruinose, pi-
 lose and macrochaetose; posterior head sur-
 face white pruinose, pilose and macrochae-
 tose; compound eyes separated from lateral

ocelli on vertex by about two-thirds the
 width of a lateral ocellus. Thorax with pro-
 notal angles gray pruinose, brown pilose and
 primarily black macrochaetose; mesonotum
 brown pilose, markings tan and brown prui-
 nose, marginal and submarginal macrochae-
 tae black and white mixed; mesopleura gray
 pruinose sparsely white pilose, dorsocaudal
 angle sparsely short white pilose, nonmacro-
 chaetose; wings with costal margin white pi-
 lose from base to about middle; scutellum
 gray pruinose, white pilose, black macro-
 chaetose. Legs (hind tibiae and tarsi missing)
 with ground color piceous, coxae gray prui-
 nose, white pilose and macrochaetose; an-
 terior and middle femora gray pruinose,
 white pilose, hind femora primarily brown
 pilose, black macrochaetose; anterior and
 middle tibiae white pilose, primarily black
 macrochaetose. Abdomen with segment one
 brown pruinose basally, expanded medially
 almost reaching posterior margin, gray prui-
 nose laterally and along apical margin, white
 pilose except for sparse brown pile and black
 macrochaetae along subapical margin; seg-
 ment two dark gray pruinose basally, white
 pruinose apically, median narrow transverse
 dorsal black fascia expanded medially, not
 reaching posterior margin, middorsal dark
 line extending from base to fascia, fascia

connected to lateral spot, pile white laterally and ventrally, brown dorsally in both light and dark areas; segment three with wide transverse black fascia expanded medially to basal margin, not reaching apical margin, basal lateral broken fascia and narrow apical margin white pruinose, dorsal surface brown pilose in both light and dark areas, lateral surface brown and white pilose, ventral surface white pilose, median dark fascia narrowly disconnected from lateral dark spot; segment four similar to three except that dorsal dark fascia is wider and broadly connected to lateral dark spot; segments five through seven gray pruinose, primarily brown pilose dorsally, white pilose ventrally. Terminalia: Exterior. Piceus; hemitergites sparsely brown pruinose dorsally, sparsely brown pilose throughout, subapical notch deep, parallel-sided; dististyles brown pruinose, sparsely brown pilose except for posterior tip which is more densely brown pilose, median notch on inner margin shallow (fig. 31), slightly inside apex of long black hairs of median projection; median projection of ninth sternite short brown pilose on basal surface, median apical margin and median apical projection with long recumbent black hair extending posteriorly over median opening between dististyles to about apical third of dististyles. Terminalia: Interior. Hemitergites with dense tuft of black pile on base of apical margin of interlocking fold, subapical margin above fold with moderately dense long black pile, small subcylindrical tuberculate area anterior and dorsal to black tuft of hair, subapical interlocking fold not heavily sclerotized, not extending to lower hemitergite margin, ventral margin membranous, irregular and foot-shaped with toe pointing anteriorly; proctiger wide basally, gradually narrowing apically to narrow neck to apical third, winglike ventral subapical expansions extending downward and anteriorly, posterior angles expanded laterally into short hooks, lateral dorsal subapical projections extending outward and upward ending as acutely pointed hornlike projections, apical middle arms extending slightly posteriorly and downward around the aedeagus; claspettes expanded basally, laterally flattened,

extending straight to bluntly rounded apex, middle inner surface with dense short golden pile, inner subapical lobes long extending inward for about half their length, curved medially and extending posteriorly, points touching on median line (fig. 54), base of lobe with dense tuft of long golden pile, remaining surface sparsely clothed with shorter golden pile; interbasal folds not extending to inner edge of dististyles, acutely pointed apically, subapical emargination broadly open, moderately densely golden pilose internally. Length 17.5 mm.; mesonotal width 3.5 mm.

FEMALE: Similar to the male except in the secondary sexual characteristics. Abdominal segments one through four with dorsolateral nonpruinose dark irregular spots, segments one through five with narrow middorsal line, segments two and three with lateral spots; retrorse (hairs directed backward toward base of abdomen) hairs brown on segments five through seven; digging spines (acanthophorites) at apex of abdomen short blunt black, 10 on each side of genital opening. Length 20 mm.; mesonotal width 4 mm.

TYPE MATERIAL: Holotype male and four male paratopotypes, allotype female and four female paratopotypes collected at White Water, Riverside County, California. The holotype and allotype were taken in copulation on August 9, 1947 by J. Wilcox. Three paratopotypes were collected July 9, 1950 by P. D. Hurd and E. G. Linsley. Three male and two female paratopotypes collected July 9, 1950 by K. G. Whitesell.

PARATYPES: California: Riverside County: Indian Wells, July 22, 1952, J. H. Nakata, one male; Palm Springs, August 9, 1947, Guy F. Toland, one male, one female; Palm Springs Station, July 21, 1952, J. W. MacSwain, D. Shepherd, four males, 12 females; Magnesia Canyon, July 21, 1952, R. E. Wagner, one male; Banning, July 21, 1952, D. Shepherd, one female.

Holotype and allotype deposited in the collection of the California Academy of Sciences, San Francisco, by J. Wilcox. Paratopotypes and paratypes deposited in the collections of the University of California at Davis, Los Angeles and Berkeley; in the col-

lection of Joe Wilcox, Anaheim, California; in the Arizona State collection, Tempe; and in the American Museum of Natural History, New York.

Since the posterior tibiae and tarsi are missing in the holotype a description of these structures is given here as represented on the male paratopotype. The tibiae are gray pruinose, brown pilose and black macrochaetose, ground color slightly lighter than femora; tarsi sparsely gray pruinose, brown pilose, black macrochaetose; pulvilli broad, two-thirds as long as claws.

ETYMOLOGY: The species is named in honor of Joe Wilcox who has contributed greatly to this project through the loan of material and personal encouragement.

ECOLOGY: No information is available on either the breeding or drinking habitats of this species.

VARIABILITY: The type series is fairly uniform in most respects. However, the dark markings on abdominal segments three and four may be more extensive but of the same pattern, there may be several black macrochaetae on the dorsal area of the back of the head, the thorax may be entirely black macrochaetose, the subapical notch on the hemitergites may be shallow and the hairs on the subapical lobes of the claspettes vary from golden to dark brown. The internal terminalia structures were studied in eight specimens in which the hemitergites and dististyles were opened and were found to have little variability. The length range in the males is 16 to 18.5 mm., whereas in the females it is from 13.5 to 20 mm.

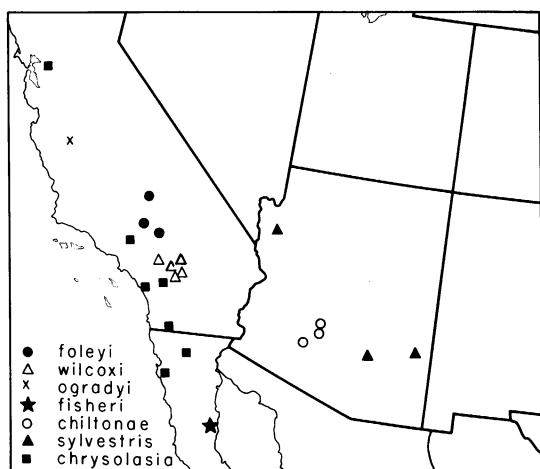
RELATIONSHIPS: *Apiocera wilcoxi* may be confused with *bigelowi* but does not appear to be closely related and their distributional ranges are widely disjunct (maps 1 and 7). *Apiocera wilcoxi* has a prominent tuft of black hair on the base of the interlocking fold of the hemitergites (see fig. 35) and a subapical notch (see fig. 33) on this structure which are lacking in *bigelowi*. In *wilcoxi* the claspettes are straight and sparsely hairy (fig. 54), whereas in *bigelowi* they are arched and nearly glabrous (see fig. 62). There are many other differences but *wilcoxi*, judging from the long black recumbent hair on the median

projection of the ninth sternite (see fig. 14), seems to be most closely related to some of the species in the *haruspex* complex with which it shares this and other characteristics. It can be separated from *haruspex haruspex* by its lighter color, more extensive white pruinose abdominal maculations, by its sparsely pilose inner claspette margin (fig. 54), completely different proctiger and many other characters.

Apiocera wilcoxi (map 1) occurs geographically, ecologically and chronologically together with *pearcei* (map 10) at Banning but they are only distantly related morphologically. In *wilcoxi* the median posterior projection of the ninth abdominal sternite has long black recumbent pile (see fig. 14), the inner dististyle margins are apposed in the apical third (see fig. 14), the locking fold on the inner hemitergite surface has a dense brush of black erect bristles on the inner midbasal margin and the proctigers are entirely different. In *pearcei* there is no recumbent long black pile on the posterior median projection of the ninth abdominal sternite (see fig. 13), the inner dististyle margins are widely separated (see fig. 13) there is no pile on the surface of the locking fold, and the proctiger is without dorsoapical spines. At Palm Springs the two species are at least sympatric.

At Magnesia Canyon *wilcoxi* is sympatric with *volucra* (map 3) but can be distinguished from it by its long sinuous ventral claspette lobes (fig. 54), its single apical emargination in the inner interbasal folds (see fig. 39), and by the dorsoapical spines on the proctiger. In *volucra* the ventral claspette lobes are short and straight (see fig. 55), the inner interbasal folds are biemarginate subapically (see fig. 38), and there are no spines on the proctiger (fig. 76).

At Palm Springs Station, *wilcoxi* is again found geographically, ecologically, and chronologically together with *pearcei* and also with *acuticauda* (map 2) and *interrupta* (map 6). It is distinct from *pearcei* as mentioned previously. From *acuticauda* it can be separated by its long sinuous ventral claspette lobes (fig. 54), its single apical emargination in the inner interbasal folds (see fig.



MAP 1. Distributions of *Apiocera* sp.: *A. foleyi*, *wilcoxi*, *ogradyi*, *fisheri*, *chiltonae*, *sylvestris*, *chrysolasia*.

39), by having more dense pile on the apices of the dististyles and by lacking the long dorsoapical posterior projections on the proctiger. In *acuticauda* the ventral claspette lobes are short and straight, the inner interbasal folds are biemarginate apically (see fig. 38), it lacks the more densely placed hairs on the apices of the dististyles, and it has long posterior projections on the apex of the proctiger. *Apiocera wilcoxi* has transverse dark abdominal black maculations and piceous black pilose terminalia, whereas in *interrupta* the abdominal maculations are linear and dorsolateral and the terminalia are testaceous and white pilose. In *wilcoxi* the dorsoventral claspette lobes are long and sinuous (fig. 54), and the apex of the proctiger is spinose. In *interrupta* the claspette lobes are medium in length and straight (fig. 60) and the proctiger has no spines apically.

2. *Apiocera foleyi*, new species

Figure 72; Map 1

DIAGNOSIS: Medium-sized, narrow; pteropleura bare anterior to metathoracic spiracles; dististyles closed ventrally in apical third from apex of median projection of ninth

sternite to apex of dististyles, inner margins with shallow indistinct median notch, apices without subapical flare of long hair; abdominal segments three and four with dorsal transverse uninterrupted dark bands; median projection of ninth sternite evenly rounded dorsoventrally, not overlapping dististyles laterally; apex of hemitergites with deep subapical notch in posterior margin, locking fold on inner surface without basal tuft of black macrochaetae; posterior tarsal pulvilli broad, more than half as long as claws; posterior tibial macrochaetae brown or black; proctiger broadly Y-shaped apically, divergent lateral arms with short dorsal vertical hornlike projection (fig. 72).

DESCRIPTION: Male: Head with front white pruinose, slightly yellowish toward vertex, white pilose, vertex sparsely brown pilose around lateral ocelli; antennal segments one and two white pruinose, pilose and macrochaetose, segment three yellowish basally, dark apically, ending in short acute tooth; palpi yellowish, white pruinose and pilose; compound eyes separated from lateral ocelli on vertex by about the width of a lateral ocellus; posterior head margin white pruinose, pilose and macrochaetose. Thorax with midpronotum white pilose, pruinose and macrochaetose, lateral angles white pruinose and pilose, black macrochaetose; mesonotum tan pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile and macrochaetae primarily brown or black, few white mixed in; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle and lower epimeral area gray pruinose, bare; wings with costal margin black pilose except for a few white hairs at base; scutellum gray and tan pruinose, brown and white pilose, marginal macrochaetae black. Legs with coxae gray pruinose, white pilose and macrochaetose, femora piceous, sparsely gray pruinose, brown and white pilose, primarily black macrochaetose, anterior pair with both black and white macrochaetae on outer margin; tibiae reddish brown, anterior pair white pilose, black macrochaetose, middle and posterior pairs brown pilose, black macrochaetose; tarsi reddish brown, anterior pair

white and brown pilose, black macrochaetose, middle and posterior pair brown pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with segment one brown pruinose in middle third from base to apex, dorsolateral areas gray pruinose to apical margin, white pilose dorsally, lateral long hairs mixed black and white, subapical marginal macrochaetae black; segment two with wide gray and brown pruinose transverse vitta in basal one-half, darker medially, median transverse black vitta bent posteriorly on either side of the center ending in truncate median projection not reaching apical margin, wide white transverse apical vitta narrowed but not interrupted medially, pile brown throughout; segments three and four with basal one-third white pruinose, narrowly interrupted medially by brown pruinosity, apical two-thirds black, apical border of segment three dark, apical border of segment four narrowly white, sparsely brown pilose throughout; segments five and six irregularly white pruinose, sparsely white pilose; segment seven dark, brown and white pilose; pleural areas on segments two through four with elongate thin areas along suture, not connected or very narrowly separated from black dorsal markings, white and brown pilose; sternites sparsely gray pruinose, white pilose. Terminalia: Exterior. Unicolorous, piceous, black and brown pilose; hemitergites with dorsal margin slightly angled downward at posterior third, apex not extending posteriorly beyond posterior margin, posterior margin with acute deep subapical notch, margin evenly rounded to ventral margin, subapical notch formed by invagination of margin into locking fold; dististyles elongate, apices attenuated into acute points, pile short and dense on dorsal subapical margin, postmedian incision in upper margin shallow and narrow, obscured by black pile; median projection of ninth sternite evenly rounded, narrow, not overlapping dististyles laterally, basal black hairs short, lateral and median long black hairs extending posteriorly to incisions in ventral dististyle margins. Terminalia: Interior. Hemitergites with sparse black pile along dorsal margin apically and

subapically, locking folds sharply elevated above hemitergite surface, strongly convoluted into narrow ridge extending posteriorly and downward at an angle, not extending to ventral hemitergite margin, tuberculate area indistinct, tubercles small, located anteriorly to dorsal marginal angulation and slightly below, not reaching dorsal margin; proctiger with lateral margins subparallel medially, expanding basally into membranous area, constricted subapically to beginning of lateral apical arms, lateral arms divergent from base of apical opening to dorsal acute projections, more strongly divergent and extending downward and outward from this point forming a lateral shield (fig. 72); claspettes slightly bent upward at base, apices curved and evenly rounded, inner margins densely golden pilose from near base to near apex, subapical ventral lobes long and straight, wide at base, gradually narrowing to acute point, outer margin densely clothed with row of long curved golden and brown hair, inner margin sparsely clothed with short golden pile, outer surface bare; interbasal folds deeply biemarginate apically in dorsal margin, golden pilose. Length 18.4 mm.; mesonotal width 3.7 mm.

FEMALE: Unknown.

TYPE MATERIAL: Holotype male collected at Garlock, Kern County, California, July 21, 1957 by F. B. Foley. One male paratype collected at Lancaster, Los Angeles County, California, August 23, 1956 by E. I. Schlinger. One male paratype collected at Desert Springs, San Bernardino County, California, August 10, 1958 by G. H. Nelson.

Holotype male deposited in the collection of the California Academy of Sciences, San Francisco by Joe Wilcox. One male paratype in the collection of the University of California, Davis. One male paratype deposited in the collection of Florida State Collection of Arthropods, State Plant Board, Gainesville by Howard Weems.

ETYMOLOGY: This species is named in honor of the late Francis B. Foley, an entomologist with the United States Department of Agriculture, an avid insect collector and explorer of deserts and mountains, who perished in a sudden spring blizzard while on a

climb to the summit of Boundary Peak, the highest mountain in Nevada.

ECOLOGY: No information is available on either the drinking or breeding sites of this species.

VARIABILITY: There is little or no variability in the three specimens, including the internal structures in the three males that were dissected and in which the definitive characteristics are found. In the Lancaster specimen the ridgelike interlocking fold extends almost to the ventral hemitergite margin and the white hairs on the base of the costal wing margin are more numerous than in the type.

RELATIONSHIPS: *Apiocera foley* can be separated from all other known species of *Apiocera* by its inverted Y-shaped proctiger (fig. 72) and by its subapical ventral lobes on the claspettes which are long, wide at base, narrowing to acute tip. It shares the attenuated acute tips of the dististyles with *acuticauda* (see fig. 44).

Apiocera foley (map 1) occurs geographically, ecologically and chronologically together with *pearcei* (map 10) at Garlock. It can be separated from *pearcei* by those characters given under relationships and by having the inner dististyle margins apposed in the apical third (see fig. 14), the inner interbasal folds biemarginate apically (see fig. 38), and by its dense golden pilose claspettes. In *pearcei* the inner dististyle margins are widely separated (see fig. 13), the inner interbasal folds have a single deep apical emargination (see fig. 39) and the dorsal inner claspette margins are sparsely golden pilose. The two species are only distantly related.

3. *Apiocera convergens* Painter

Figure 98; Map 3

Apiocera convergens Painter, 1936, p. 196.

DIAGNOSIS: Male: Small-sized, narrow, pteropleura bare anterior to metathoracic spiracles; dististyles closed ventrally from transverse postmedian incisions in inner dististyle margin to near apex (see fig. 14); median posterior projection of ninth sternite with long black recumbent pile extending

posteriorly from basal and lateral margins and middorsum to or slightly beyond transverse incisions in dististyles (see fig. 14); dark dorsal maculations on abdominal segments three and four interrupted dorsolaterally by longitudinal gray or white vittae (fig. 98). Terminalia: Interior. Claspettes with ventral subapical lobes medium in length, straight, ventral claspette margins with median golden hairs long, curved downward and inward beneath proctiger and aedeagus (see figs. 58, 61); inner interbasal folds deeply biemarginate dorsoapically (see fig. 38); inner surface of hemitergite locking folds bare, midbasal margin near connection with hemitergite with tuft of short black erect bristle-like hairs (see fig. 33); proctiger without Y-shaped apex.

FEMALE: Abdominal dorsolateral dark maculations longitudinal, elongate, oblong and narrow; dorsocaudal angle of mesopleura bare; costal wing vein entirely or primarily black pilose; dorsal posterior head surface black and white macrochaetose.

TYPE LOCALITY: "Cal.," C. W. Riley. Holotype male, allotype female in the National Museum of Natural History, Washington, D.C., catalogue number 51436.

DISTRIBUTION: California: Riverside County: Mira Loma, August 28, 1962, J. Wilcox and August 31, 1941, G. F. Toland, J. Wilcox. Los Angeles County: Baldwin Park, September 5, 1941, G. F. Toland; Claremont, August 31, 1941, J. Wilcox, G. F. Toland. San Bernardino County: Rialto, August 15, 1956, E. G. Linsley, P. D. Hurd.

ECOLOGY: No information available.

RELATIONSHIPS: *Apiocera convergens* appears to be most closely related to *notata* and the two species are the only ones in the genus that have the long ventral golden hairs from the claspettes extending down and under the proctiger and aedeagus (see figs. 58, 61). *Apiocera convergens* is smaller than *notata* and has the dark maculations on abdominal segments three and four interrupted dorsolaterally (fig. 98). In *notata* these segments are almost completely shiny black and are not interrupted dorsolaterally (fig. 97). Although the two species have not yet been found sympatrically, *convergens* (map 3) oc-

curs near the middle of the distribution of the more widely ranging *notata* (map 12) and some of the locations are separated by only a few miles.

4. *Apiocera notata* Painter

Figures 58, 61, 97; Map 12

Apiocera notata Painter, 1936, pp. 199–200.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura bare anterior to metathoracic spiracles; dististyles closed ventrally from transverse incisions in inner dististyle margins to near apex (see fig. 14); dorsal abdominal segments three and four almost entirely shiny black (fig. 97), not interrupted dorso-laterally; median posterior projection of ninth abdominal sternite with long black recumbent pile extending from basal and lateral margins and dorsum posteriorly beyond transverse incisions in inner dististyle margins (see fig. 14). Terminalia: Interior. Claspettes with ventral subapical lobes medium in length, straight (fig. 58); inner interbasal folds deeply biemarginate dorsoapically (see fig. 38); inner surface of hemitergite locking folds bare, midbasal margin near connection with hemitergite surface with tuft of short black erect bristle-like hairs (see fig. 33); proctiger not Y-shaped apically.

FEMALE: Abdominal dorsolateral dark maculations in variously shaped spots; posterior tarsal pulvilli more than half as long as claws; pteropleura bare; outer surface of posterior femora and tibiae primarily brown or black pilose; abdominal segment four with discal pile usually white.

TYPE LOCALITY: Campo, San Diego County, California, August 10, 1935, E. I. Beamer. Holotype male, allotype female in the Snow Collection, University of Kansas, Lawrence.

DISTRIBUTION: California: Santa Barbara County: Los Prietos, July 12, 1965, M. R. Gardner; Santa Ynez Mountains, June 24, 1959, J. R. Russell. Ventura County: Foster Park, July 7, 1959, R. M. Bohart; Sespe, July 10, 1959, P. E. Paige, F. D. Parker. Los Angeles County: Claremont, August 31, 1941,

J. Wilcox, G. F. Toland. San Bernardino County: Mouth of Deep Creek, August 6, 1956, E. I. Schlinger; Lytle Creek, July 31, 1976, James O'Grady. Riverside County: Anza, July 5, 1956, R. M. Bohart. San Diego County: Mt. Palomar, August 24, 1949, C. H. Martin; Rincon Springs, July 27 (no year), J. Wilcox; 2 miles north Warner Springs, July 8, 1956, R. M. Bartosh, R. M. Bohart; vicinity Descanso, July, 1955, P. H. Arnaud, Jr. Mexico: Baja California Norte: Sierra Juarez, 11 miles southwest Sawmill, 5200 feet, July 16, 1969, S. C. Williams, V. F. Lee; Sierra Juarez, 2 miles south Rancho El Topo, 5400 feet, July 9, 1969, S. C. Williams, V. F. Lee; Rancho Viejo, Sierra San Pedro Martir, elevation 7000 feet, June 15, 1953, P. H. Arnaud, Jr.

ECOLOGY: No information available.

RELATIONSHIPS: *Apiocera notata* (map 12) occurs geographically, ecologically and chronologically together with *chrysolasia* (map 1) at Rancho El Topo, with *barri* (map 2) at Los Prietos and sympatric with *acuticauda* (map 2) at Mouth of Deep Creek. *Apiocera notata* can be separated from all the above species by having the long ventral golden hairs on the claspettes extending downward and internally beneath the proctiger and aedeagus (fig. 61). See discussion under *convergens*. In the other three species these hairs are short and arranged fanlike (see fig. 57). *Apiocera barri* can be separated from *notata*, *acuticauda* and *chrysolasia* by having the hemitergite locking fold extending ventrally below the ventral hemitergite margin (fig. 35) and by the ventral subapical lobes of claspettes which are medium in length, straight and with the long golden hairs confined to a basal tuft (fig. 55). In the other three the locking fold does not reach the ventral hemitergite margin (see figs. 33, 34) and the long hairs on the ventral subapical lobes on the claspettes extend along the outer margin (see fig. 58). In *chrysolasia* the proctiger has prominent, rough subapical lateral expansions (fig. 79). In *acuticauda* the apical projections extend posteriorly and in *notata* there are no prominent lateral or posterior projections. The four species are not very closely related.

5. *Apiocera horticola*, new species

Figures 56, 78; Map 6

DIAGNOSIS: Medium-sized, narrow; pteropleura bare, gray pruinose in front of metathoracic spiracles; dististyles closed ventrally from wide transverse incision in inner margin posteriorly to near apices (see fig. 14), without subapical flare of long hair; posterior tarsal pulvilli broad, more than half as long as claws; abdominal dark markings on segments two through four in transverse bands including middorsal area; posterior tibial macrochaetae black; hemitergites with subapical acute or obtuse notch in posterior margin; proctiger not Y-shaped apically; locking fold not extending ventrally to hemitergite margin; ventral lobes of claspettes short and straight, golden pilose (fig. 56); dorsolateral apical arms of proctiger not or but little produced posteriorly beyond apex of subapical dorsal opening (fig. 78); costal wing vein completely or primarily black pilose basally; outer margin of lateral apical arms of proctiger without subdorsal indentations or thickenings (fig. 78); dark transverse bands on abdominal segments three and four usually completely or partially interrupted dorsolaterally by longitudinal gray pruinose vittae.

DESCRIPTION: Male: Head with front white pruinose ventrally, yellowish pruinose dorsally, white pilose below median ocellus, black pilose between ocelli and on vertex; antennal segments one and two white pruinose, pilose and white macrochaetose except for a few black hairs and one black macrochaeta on each of these two segments, segment three dark pruinose, ending in short acute tooth; palpi with base dark, yellowish apically, white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by almost the width of a lateral ocellus; posterior head margin tan and gray pruinose, white pilose, black and white macrochaetose, dorsal macrochaetae primarily black. Thorax with median pronotal area tan pruinose, white pilose, black and white macrochaetose, pronotal angles gray pruinose, black pilose and macrochaetose; mesonotum tan pruinose, markings

brown pruinose, discal sparse short hairs brown, marginal and submarginal pile primarily brown with only a few white, macrochaetae black; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle gray pruinose sparsely pilose ventrally above junction with pleural suture; wings with costal margin black pilose throughout; scutellum gray and tan pruinose, black pilose, marginal macrochaetae black. Legs with coxae gray pruinose, white pilose, white macrochaetose except for two black ones on left and one on the right posterior coxae; femora piceous gray pruinose, anterior and middle pair primarily white pilose and black macrochaetose, posterior pair black pilose and macrochaetose; tibiae and tarsi black pilose and macrochaetose; tarsal pulvilli moderately broad, two-thirds as long as claws. Abdomen narrowly tan pruinose basally, median one-third brown pruinose, narrowly reaching basal margin, broadly reaching apical margin, dorsolateral white pruinose areas reaching apical margin, pile primarily white basally, brown apically, lateral apical long pile primarily black, submarginal apical macrochaetae black; segment two tan pruinose basally, median dark marking diamond shaped, narrowly connected to basal and apical margins, dorsolateral longitudinal white pruinose vittae separating median dark diamond from median lateral rounded dark spots, pile black throughout; segment three with wide median longitudinal black area extending from basal to apical margin, separated from dorsolateral median rounded black spots by dorsolateral longitudinal tan pruinose vittae, pile black throughout; segment four with W-shaped dark maculations, dorsolateral tan pruinose vittae extending from basal margin posteriorly to middle of segment, transverse posterior portion of black area about one-third width of segment, apical margin narrowly white pruinose, pile black throughout, segment five white pruinose except for narrow median dark longitudinal line and small dorsolateral indistinct apical spot, pile white basally, brown apically; segment six brown and white pruinose, black pilose; segment seven brown pruinose, black pilose; pleural areas of segments two through four with elongate,

brown pruinose spots and bands along suture, not connected with dorsal dark markings, black and white pilose; segment five with small brown pruinose spot at base on pleural suture, pile white; sternites gray pruinose, white pilose. Terminalia: Exterior. Unicolorous brown, slightly darker brown basally, sparsely black pilose throughout on dististyles and hemitergites; hemitergites with dorsal margin shallowly emarginate at apical one-quarter, protruding apically slightly beyond posterior margin, posterior margin with acute subapical notch, margin evenly rounded from notch to ventral margin; dististyles evenly rounded apically, without tuft of long hair, ventral margin with wide deep transverse incision at about apical third, surface at base brown pruinose, smooth and shiny apically; median projection of ninth sternite flat (pushed abnormally outward in type), not overlapping dististyles laterally, outer basal areas on each side of narrow median projection with short black pile, inner basal areas, sides and surface of median projection with long black hairs extending posteriorly almost to transverse incisions in ventral dististyle margins. Terminalia: Interior. Hemitergites with sparse black pile along margin above base of locking fold, sparse black tuft of short hairs at mid-base of locking fold, locking fold sharply elevated above hemitergite surface, extending horizontally to it, basal area depressed to surface, ventral margin not reaching ventral hemitergite margin, tuberculate area small, elongate, anterior to dorsal margin emargination, not reaching dorsal margin; proctiger wide dorsally, margins subparallel medially, expanded basally into membranous area, constricted at about apical third, abruptly expanded to apical arms and median dorsal opening, apical arms extending from posterior angles of dorsal opening, sharply outward laterally, downward and anteriorly at a 45-degree angle, posterior margin smooth and rounded, no extensions posterior to dorsal apical opening (fig. 78); claspettes straight longitudinally, bent sharply upward at base, ending apically in evenly rounded margin, not bent downward, moderately densely golden pilose along inner dorsal margin from

near base to near apex, subapical ventral lobes short, surface with sparse short golden pile, outer edge at base with sparse tuft of long inward curved black hairs (fig. 56); interbasal folds deeply biemarginate apically in dorsal margin, apical and median projections golden pilose. Length 18.5 mm.; mesonotal width 4.3 mm.

FEMALE: Similar to the male except in the usual sexual characteristics. The body is primarily tan pruinose, the legs are reddish brown and the abdominal markings consist of middorsal dark bare areas on segments one through four, dorsolateral dark areas on segments two through four and indistinct irregular pleural areas on segments two through four. Length 16.4 mm.; mesonotal width 4.2 mm.

TYPE MATERIAL: Holotype male, allotype female, 17 male and three female paratopotypes collected at Santa Ana, Baja California Norte, Mexico, June 21, 1968 by N. Leppla, J. Davidson, J. Bigelow, M. Bentzien, W. Fox, S. Williams, and M. Cazier.

PARATYPES: Mexico: Baja California Sur: San Juan, June 29, 1968 by same collectors as primary types, two males. Baja California Norte: 8 miles northwest Rosarito, July 2, 1973, E. Fisher, R. Westcott, two males, one female; 13 miles south Rosarito, July 2, 1973, E. M. Fisher, one male, two females.

Holotype male, allotype female and paratopotypes in the collection of the American Museum of Natural History, New York. Paratopotypes and paratypes in the collection of Arizona State University, Tempe. Paratypes in the collection of E. M. Fisher, Riverside, California.

ETYMOLOGY: From the Latin *hortus*, meaning a garden and *colo*, meaning to dwell. This describes the situation in which the type series was collected.

ECOLOGY: The type series from Santa Ana was collected on moist, sandy soil along irrigation ditches in a backyard garden. The two specimens from San Juan were also collected on moist, sandy soil but around a spring seepage and were found associated with *bibula* Cazier at this drinking site.

VARIABILITY: Most of the variability in *horticolis* is in the abdominal markings

which vary from having the dark areas on segments three and four barely interrupted dorsolaterally to having them completely or almost completely interrupted by dorsolateral white or tan pruinose longitudinal vittae. The dark dorsal markings on segment four may or may not be connected with those along the pleural suture. Aside from this, the series of 29 specimens from four locations exhibits little variability in major structures. This comparative uniformity is also exhibited in the dissected terminalia of the 15 male specimens.

RELATIONSHIPS: *Apiocera horticolis* can be separated from *bibula* and *volucra*, with which it appears to be most closely related, by having the ventral lobes of the claspettes short and straight rather than medium to long and straight (fig. 56). From *bibula* it differs by not having posterior ventral projections on the proctiger (fig. 78) and by having an acute subapical notch in the posterior hemitergite margin. From *volucra* it can be further distinguished by having the dark abdominal markings interrupted in most specimens. From *chrysolasia*, *horticolis* can be distinguished by its evenly rounded, not indented, or thickened, outer margins of the lateral apical arms of the proctiger (fig. 78).

Apiocera horticolis (map 6) occurs geographically, ecologically, and chronologically together with *bibula* (map 10) and *dauidsonorum* Cazier (map 7) at San Juan. It can be separated from *bibula* as given above and from *dauidsonorum* as discussed under that species.

6. *Apiocera chrysolasia*, new species

Figure 79; Map 1

DIAGNOSIS: Medium- to small-sized, narrow; pteropleura bare, white pruinose in front of metathoracic spiracles; dististyles closed ventrally from narrow transverse incision posteriorly to near apex (see fig. 14), without subapical flare of long hairs; posterior tarsal pulvilli broad, more than half as long as claws; abdominal black markings on segments two through four in transverse bands or spots including middorsal area; posterior tibiae black macrochaetose; hemiter-

gites with deep subapical notch in posterior margin; proctiger not Y-shaped apically; locking fold with single median convolution, not extending ventrally to hemitergite margin; ventral lobes of claspettes golden pilose; dorsolateral apical arms of proctiger not or but little produced posteriorly beyond apex of subapical dorsal opening (fig. 79); costal wing vein completely or primarily black pilose basally; outer margin of lateral apical arms of proctiger irregular (fig. 79); long hairs on median projection of ninth sternite usually golden at least in part.

DESCRIPTION: Male: Head with front white pruinose and pilose below median ocellus, vertex and area between ocelli white pruinose, brown pilose; antennal segments one and two white pruinose, pilose and macrochaetose except for one or two short black macrochaetae on segment two, segment three dark, pruinosity at base fine, coarse apically, ending in short acute tooth; palpi (missing on left side) pale yellowish, white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by less than the width of a lateral ocellus; posterior head surface white and pale yellowish pruinose, white pilose, primarily white macrochaetose, ten black macrochaetae in middorsal area. Thorax with protergum tan pruinose, black and white macrochaetose, lateral pronotal angles tan pruinose, black pilose and macrochaetose; mesonotum tan pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal hairs black and white mixed, macrochaetae black; mesopleura gray pruinose, anterior episternal area sparsely clothed with brown and white hair, dorsocaudal area anterior to wing base gray pruinose, bare except for few short brown hairs along ventral margin above junction with pleural suture; wings with costal margin black pilose throughout; scutellum brown pruinose and pilose, marginal macrochaetae black. Legs with anterior and middle coxae gray pruinose, white pilose and macrochaetose, posterior coxae gray pruinose, white pilose, black and white macrochaetose; anterior and middle femora densely gray pruinose, brown and white pilose, black macro-

chaetose, posterior femora piceous, sparsely gray pruinose, brown pilose and black macrochaetose; anterior and middle tibiae reddish brown, sparsely gray pruinose, brown and white pilose, black macrochaetose, posterior tibiae piceous, sparsely gray pruinose, brown pilose and black macrochaetose; tarsi reddish brown, sparsely or nonpruinose, black pilose and macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with segment one brown pruinose except for small dorsolateral gray pruinose spots, pile brown and white mixed, subapical marginal macrochaetae black, lateral apical dense pile black and white mixed; segment two with basal third brown pruinose, middle third with bidentate black transverse vitta, apical third and margin white pruinose, dorsolaterally extending basally into black median vitta, surface brown and black pilose; segment three with dorsolateral tan pruinose basal band, wide black transverse median vitta extending to basal and apical margins medially, subapical margin dorsolaterally with irregular tan pruinose narrow bands interrupted medially, apical margin black; segment four with dorsolateral basal tan pruinose band interrupted medially by black diamond-shaped basal spot, dorsolateral black spots separated medially by tan to white median pruinose area connected to white apical margin, surface brown and black pilose; segments six and seven white pruinose, white pilose basally, brown and black pilose apically; segments eight and nine brown pruinose, brown and black pilose; pleural area white and brown pilose, segments two and three with brown to black pruinose median sutural spots not connected to dorsal transverse black vittae, segment four with dorsolateral dark areas extending to pleural suture; sternites gray pruinose, white pilose. Terminalia: Exterior. Piceous, hemitergites and dististyles sparsely black pilose, long hairs on median projection of ninth sternite black basally gradually turning golden apically; hemitergites with dorsal margin shallowly emarginate at apical third, apex protruding slightly beyond posterior margin, posterior margin with deep, acute subapical notch, margin evenly rounded to

straight ventral margin; dististyles narrow, evenly rounded apically, without subapical tuft of long hair, ventral margin with narrow deep postmedian incision closed ventrally from postmedian incision to near apex; median projection of ninth sternite flat, not overlapping dististyles laterally, basal areas on each side of narrow median projection with short to medium long black to golden hairs, sides and middle of narrow projection with long black to golden hairs extending posteriorly beyond marginal incision in dististyles. Terminalia: Interior. Hemitergites with sparse black short hairs along dorsal margin from emargination to apex, tuft of three short erect black hairs at midbase of locking fold, locking fold sharply elevated above hemitergite surface, extending horizontally to it and not projecting to ventral hemitergite margin, descending portion foot-like, twisting interiorly into basal convolution, basal margin extending out of convolution posteriorly to attachment on surface, midventral portions clothed with short golden erect hairs, tuberculate area small oblong angulate posteriorly, midway between base of locking fold and dorsal margin; proctiger broad dorsally, margins subparallel in median third, expanded basally into membranous area, widened apically to posterior dorsolateral arms, median apical opening between base of arms deep and rounded, dorsolateral posterior arms extending laterally downward and slightly posteriorly, posterior margin of arms deeply indented near dorsal connection, irregular in descending portion, surface shallowly rugged (fig. 79); claspettes angulate dorsally from near base, apex rounded, projecting downward, dorsal margin moderately densely golden pilose, subapical ventral lobes short straight, sharply pointed apically, surface sparsely golden pilose, apical margin, except at tip, with long curved golden hairs; interbasal folds deeply biemarginate apically in dorsal margin, median separation golden pilose. Length 19.2 mm.; mesonotal width 4.2 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The abdominal pruinosity is gray on segments two and three and tan on segment four, seg-

ments two through four have dorsolateral subtriangular black maculations and brown pruinose bands along the pleural suture. The setae on anterior femora are primarily white and the legs are reddish brown. Length 17.8 mm.; mesonotal width 4.4 mm.

TYPE MATERIAL: Holotype male collected at Temecula, Riverside County, California, July 21, 1956 by Joe Wilcox. Allotype female collected at Olivehain, San Diego County, California, August 31, 1955 by R. K. Washino.

PARATYPES: California: San Diego County: Olivehain, August 31, 1955, R. K. Washino, one male, one damaged female; Barrett, August 12, 1947, W. M. Pearce, one male. Orange County: San Clemente, July 26, 1949, C. H. Martin, two males. Los Angeles County: San Fernando, August 15, 1963, A. J. Basinger, one male. Contra Costa County: Antioch, August 21, 1948, September 8, 1948, P. D. Hurd, J. W. MacSwain, two males. Mexico: Baja California Norte: Sierra Juarez, 2 miles south Rancho El Topo, 5400 feet, July 9, 1969, S. C. Williams, V. F. Lee, two males; 12 miles southeast Santo Tomas, June 30, 1973, E. M. Fisher, two males.

Holotype male deposited in the collection of the California Academy of Sciences, San Francisco by Joe Wilcox; allotype female in the collection of the University of California, Davis. Paratypes in the collections of the University of California, Berkeley and Davis; the California Academy of Sciences, San Francisco; the American Museum of Natural History, New York; Arizona State University, Tempe; and in the collection of E. M. Fisher, Riverside, California.

ETYMOLOGY: From the Greek *chryso*, golden and *lasi*, meaning hairy which is descriptive of the long curved golden hairs on the ventral lobes of the genital claspettes and the long usually golden or partially golden hairs on the median projection of the ninth abdominal sternite.

ECOLOGY: No information is available on either the drinking sites or breeding habitats of this species.

VARIABILITY: The variability in the abdominal dark markings is great not only with-

in a single area but also between areas. They vary from having the dark transverse vitta interrupted as in the holotype to having tan pruinosity in dorsolateral narrow bands on segment three with segment four all black. Most variations between these conditions exist even though only 11 males were available for study. When the posterior lateral arms lack the marginal indentations the margin is thickened and rugged. The minute golden pile on the locking fold varies in extent and the golden pile on the dorsal margin of the claspettes varies from moderate to very dense. Twelve males had the terminalia opened for study.

RELATIONSHIPS: *Apiocera chrysolasia* appears to be most closely related to *bibula* and *horticolis*, but can be separated from both of these species by its indented or thickened posterior margins of the lateral apical arms of the proctiger (fig. 79) and usually by the long golden hair on the median projection of the ninth sternite. From *volucra*, which some of the specimens resemble, it can be separated by its short subapical lobes of the claspettes, by the short fine golden pile on the ventral portion of the locking folds on the hemitergites and the characters given above for separation from *bibula* and *horticolis*. *Apiocera chrysolasia* (map 1) occurs sympatrically with *barri* (map 2) at the Antioch location and resembles that species in both size and abdominal maculations. However, the two are easily separated since *barri* has the dorsal apical arms of the proctiger extending posteriorly well beyond the lateral arms, the ventral lobes of the claspettes have the surface bare or with sparse short golden bristles and the long hairs are confined to a basal cluster (fig. 55), the locking folds on the hemitergites have the surface glabrous and extend to or beyond the ventral hemitergite margin (fig. 35). At 2 miles south of Rancho El Topo *chrysolasia* occurs sympatrically with *notata* (map 12) with which it bears a close superficial resemblance. However, *notata* lacks the subapical notch in the posterior hemitergite margin, it has a narrow proctiger which terminates posteriorly in a toplike enlargement and is without

dorsolateral apical arms (fig. 61), the interbasal folds have only a single emargination apically in the dorsal margin.

7. *Apiocera ogradyi*, new species

Map 1

DIAGNOSIS: Medium-sized, moderately robust; pteropleura bare anterior to metathoracic spiracles; dististyles without subapical flare of long hair, closed ventrally from transverse incisions in inner margins to near apex; posterior tarsal pulvilli moderately broad, more than half as long as claws; abdominal dark markings include middorsal bicolored spots; posterior tibial macrochaetae black; hemitergites with acute subapical notch in posterior margin; proctiger not Y-shaped apically; locking fold not extending ventrally to hemitergite margin; ventral lobes of claspettes pilose; dorsolateral apical arms of proctiger not produced posteriorly beyond apex of subapical dorsal opening; costal wing vein entirely or partially white pilose basally.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex sparsely brown pilose between lateral ocelli; antennal segments one and two white pruinose, pilose and macrochaetose, segment three dark pruinose, ending in short acute tooth; palpi white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about one-half the width of a lateral ocellus; posterior head margin white pruinose, pilose and macrochaetose. Thorax with median pronotal area white pruinose, pilose and macrochaetose, lateral angles light tan pruinose, black and white pilose, black macrochaetose; mesonotum tan pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile brown and white mixed, macrochaetae black; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle white pruinose, bare except for sparse white and brown pile near bottom above junction with pleural suture; wings with costal vein primarily white pilose basally, with few black hairs along upper margin, black pilose except at base; scutellum tan and gray prui-

nose, sparsely white pilose, marginal macrochaetae black and white, two median ones white. Legs with coxae white pruinose, pilose and macrochaetose; femora piceous, sparsely gray pruinose, anterior and middle pair white pilose and macrochaetose, posterior pair brown and white pilose, primarily black macrochaetose, few white near base; tibiae reddish brown, anterior pair white pilose, primarily black macrochaetose, middle and posterior pairs brown pilose, black macrochaetose; tarsi reddish brown, anterior and middle pair brown and white pilose, black macrochaetose, posterior pair brown pilose, black macrochaetose; tarsal pulvilli moderately broad, two-thirds as long as claws. Abdomen with segment one pale brown pruinose medially from basal to apical margins, white pruinose laterally, basal margin narrowly tan pruinose, pile white except for few black hairs mixed with white laterally, subapical margin with row of black macrochaetae; segment two pale tan pruinose, white pilose in basal half, interrupted medially by pale brown basal extension of median black maculation, apical half white pruinose, black pilose, median black maculation U-shaped surrounding brown pruinose center, dorsolateral median brown spots small, not connected to median spot; segment three white pruinose and pilose in basal third, pale tannish and sparsely black pilose in apical two-thirds, maculations as on segment two but larger, dorsolateral spots almost touching median spot; segment four with median pale brown pruinose area widest basally, not reaching margin, narrowly constricted apically, reaching margin, dorsolateral brown pruinose subtriangular spots extending from near median spot parallel to apical margin, narrowing basally to basal one-third, meeting oblique margin from middle, surface tannish white including apical margin, black and white pilose; segments five and six white pruinose and pilose, segment six with narrow longitudinal median dark line from base to apical margin; segment seven dark, sparsely gray pruinose laterally, white pilose; segment eight brownish red, black pilose; pleural areas with segments two through four

gray pruinose, white pilose, slightly darker along margin, segments five through seven white pruinose and pilose; sterna of segments two through four mottled gray pruinose, white pilose, segments five through seven mottled white pruinose, white pilose. Terminalia: Exterior. Unicolorous reddish brown, hemitergites, dististyles and base of ninth sternite sparsely black pilose, median projection of ninth sternite densely golden pilose; hemitergites with dorsal margin sharply shallowly angulate at apical third, evenly shallowly rounded to apex, not protruding beyond posterior margin, posterior margin with deep parallel-sided subapical notch, margin evenly rounded to evenly rounded ventral margin; dististyles shortened and closed apically, apex bluntly evenly rounded, ventral margin with narrow transverse postmedian incision; median projection of ninth sternite flat not overlapping dististyles laterally, basal and basal lateral short pile black, lateral and median long dense recumbent hairs golden, extending posteriorly to and slightly beyond transverse incisions in dististyle margins. Terminalia: Interior. Hemitergites with sparse black pile along apical half of dorsal margin posterior to emargination, anterior end of row of hairs extending obliquely downward and anteriorly to tuft of short erect black hairs on mid-base of locking fold, locking fold sharply elevated above hemitergite surface, strongly convoluted dorsally and laterally, forming narrow oblique ridge, not reaching ventral hemitergite margin, surface minutely golden pilose, tuberculate area large, rounded, situated in concavity anterior and dorsal to base of locking fold, not reaching dorsal margin; proctiger broad dorsally, lateral margins subparallel from lateral apical arms to basal expansion into membranous area, dorsomedian apical opening transverse, narrow, not closed posteriorly, lateral apical arms extending laterally outward, downward and slightly anteriorly from apex of dorsal opening, posterior margins irregular, shallowly indented subdorsally, not extending posteriorly from apical margin of middorsal opening; claspettes slightly angulate dorsally from near base to broadly rounded apices, inner

margins from near base to near apex densely golden pilose, subapical ventral lobes short, sparsely golden pilose, apical margin with row of long curved golden hairs; interbasal folds deeply biemarginate in dorsal margin, apical emargination golden pilose. Length 26 mm.; mesonotal width 4.5 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The head, mesonotum, and abdominal terga are tan pruinose, the macrochaetae are primarily white, the dorsolateral abdominal markings on segments two through four are subtriangular and median, not connected to elongate spots in pleural area, pile predominantly white, middorsal brown pruinose area at base on segment two, indistinct dark median longitudinal line on segments two and three, distinct middorsal dark line on segment four. Length 17.3 mm.; mesonotal width 4.3 mm.

TYPE MATERIAL: Holotype male, allotype female collected at Panoche Creek, San Benito County, California, August 30, 1975 and August 14, 1976, respectively, by James O'Grady. Four paratopotypic males and five females collected on August 30, 1975 by J. O'Grady. One paratopotypic male and seven females collected on August 14, 1976 by J. O'Grady.

Holotype male, allotype female deposited in the collection of the California Academy of Sciences, San Francisco by James O'Grady. Paratopotypes in the collections of the American Museum of Natural History, New York; Arizona State University, Tempe; and James O'Grady, Tucson, Arizona.

ETYMOLOGY: The species is named in honor of James O'Grady who supplied the author with material of critical importance in this study, including new species, topotypical specimens of *beameri*, the only species the author had not previously seen, and many fine distributional records.

ECOLOGY: According to James O'Grady (personal commun.), "*Apiocera ogradyi* occurs in a very arid area in the Griswold Hills about 3 miles south of Panoche which is about 60 miles west of Fresno. They seem to be associated with desert salt-bush, *Atriplex polycarpa* under which they seek shelter during the hot parts of the day. I've seen them

feed on what appears to be honeydew droppings on the ground beneath the plants. They appear to be restricted to a waterless area about 100 feet square. The reddish color of the male genitalia is much more apparent when the flies are alive."

VARIABILITY: In the series of seven males, one without terminalia, the pro- and mesonotal macrochaetae may be all white, the pile on the base of the costal wing vein may be about half and half black and white, the dorsolateral dark markings on abdominal segments three and four may be connected medially in the basal third and the locking fold on the inner hemitergite surface may not be convoluted basally and can be flattened on the inner surface. In the four dissected males the terminalia structures show little variability. In the series of 13 females the abdominal markings vary from the condition in the allotype to being almost completely absent, and the white pile on the costal wing vein may extend to the apical third of the wing.

RELATIONSHIPS: *Apiocera ogradyi* appears to be most closely related to *chrysolasia* but can be separated from it by its more spotted abdominal maculations, lighter color, and by its predominantly white pilose costal wing vein. From *pearcei*, which occurs nearby, it can be easily separated by having the dististyles closed ventrally (see fig. 14), by its dense golden pile on the ninth abdominal sternite, and short ventral apical lobes on the claspettes. There are numerous other differences. From *barri* which also occurs in the general vicinity, it can be easily separated by its spotted abdominal maculations, by not having the dorsolateral proctigal arms extending posteriorly, by having the ventral lobes of the claspettes short and golden pilose (see fig. 55) and by its reddish brown terminalia. From *beameri* it is separable by its closed ventral dististyles (see fig. 14), spotted abdominal pattern (see fig. 113), shorter white abdominal pile, biemarginate interbasal fold (see fig. 38) and short ventral lobes on the claspettes.

At the present time *ogradyi* (map 1) is allopatric, although narrowly so, with *pearcei* (map 10) which has been collected in the Ciervo Hills about 20 miles southeast of the

type locality of *ogradyi*. *Apiocera chrysolasia* (map 1) and *barri* (map 2) occur both north and south of *ogradyi* and *beameri* (map 9) occurs in Santa Barbara County south of *ogradyi* and at 8 miles west of Kernman in Fresno County, about 40 miles northeast of the type locality of *ogradyi*. The four species can be separated from *ogradyi* as given under relationships.

8. *Apiocera barri*, new species

Figures 3, 35, 55; Map 2

DIAGNOSIS: Medium-sized, narrow; pteropleura bare, gray pruinose in front of metathoracic spiracles; dististyles closed ventrally from wide postmedian deep transverse incisions to near apices, without subapical flare of long hair; posterior tarsal pulvilli broad, two-thirds as long as claws; abdominal dark markings on segments two through four in transverse bands including middorsal area; hind tibial macrochaetae black; hemitergites with deep parallel margined acute subapical notch (fig. 35); proctiger not Y-shaped apically; locking fold strongly convoluted, extending ventrally to or below hemitergite margin (fig. 35); ventral lobes of claspettes moderately long and straight, surface glabrous or with sparse short erect golden bristle-like hairs, outer margin at base with sparse cluster of long straight golden, brown or black hairs (fig. 55).

DESCRIPTION: Male: Head with front white pruinose and pilose below median ocellus, pale yellowish pruinose and black pilose between and behind ocelli; antennal segment one white pilose, pruinose and macrochaetose, segment two white pruinose, pilose, black and white macrochaetose, segment three black, finely white pruinose, ending in short acute tooth; palpi pale yellowish, white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by almost the width of a lateral ocellus; posterior head margin tan and white pruinose, white pilose, black and white macrochaetose. Thorax with midpronotum white and tan pruinose, white pilose, black and white macrochaetose, later-

al angles white and brown pruinose, black pilose and macrochaetose; mesonotum gray, tan and brown pruinose, markings brown pruinose, discal sparse short hairs black and brown, marginal and submarginal pile and macrochaetae black; mesopleura gray and white pruinose, sparsely white and brown pilose, dorsocaudal angle light tannish pruinose, bare; wings with costal margin black pilose from base to near apex; scutellum brown and gray pruinose, black pilose, and macrochaetose. Legs with anterior and middle coxae white pruinose, pilose and macrochaetose, posterior pair gray pruinose, black and white pilose and macrochaetose; femora black, moderately densely gray pruinose, black and white pilose, black macrochaetose; tibiae piceous, sparsely gray pruinose, anterior and middle pair black and white pilose, black macrochaetose; tarsi piceous, black pilose and macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with segment one gray pruinose dorsolaterally along basal margin and small indistinct spot medially dorsolaterally, remainder brown pruinose, white pilose except for mixed black and white pile in lateral dense tufts, subapical margin black macrochaetose; segment two tricolored, basal third brown pruinose with median posterior extension bordered posteriorly by narrow black transverse vitta, posterior third white pruinose, not completely interrupted medially by black vitta, widest dorsolaterally, pile white in basal third, black in apical two-thirds; segment three with dorsolateral white pruinose areas along basal and apical margins, widest basally and forming a continuation with white apical vitta on segment two, wide median black transverse vitta reaching apical and basal margins medially, pile black throughout; segment four like segment three except for thin continuous white pruinose apical margin; segments five and six white pruinose basally and medially, dorsolateral apical areas brown pruinose, pile white basally, black pilose in apical two-thirds; segments seven and eight brown pruinose, black pilose; pleural areas gray pruinose, segments two and three each with small dark isolated spot in apical third, pile white on segment

two, black and white on segment three, segment four with dorsal black maculation reaching almost to pleural suture along apical margin, pile black, segments five and six white pruinose and pilose, segment seven gray pruinose, black pilose; sternites of segments two through four gray pruinose, white pilose, segments five and six white pruinose, primarily white pilose, segment seven gray pruinose, black pilose, segment eight brown pruinose, black pilose. Terminalia: Exterior. Unicolorous, reddish brown, black pilose throughout; hemitergites with dorsal margin shallowly emarginate at apical third, slightly curved to evenly rounded apex, apex slightly enlarged, extending posteriorly beyond posterior margin, posterior margin with deep, acute subapical notch, margin evenly rounded to ventral margin; dististyles long, evenly rounded apically, without tuft of long hair, ventral margin with wide postmedian transverse incision, closed ventrally from incision to near apex; median projection of ninth sternite flat, not overlapping dististyles laterally, basal areas on each side of narrow median projection densely clothed with long and short black recumbent pile, median area sparsely clothed with long recumbent pile, long hairs extending posteriorly to or slightly beyond marginal incisions in dististyles. Terminalia: Interior. Hemitergites with sparse black pile below dorsal margin from bottom of emargination to apex, moderately dense tuft of erect bristle-like black hairs above basal attachment of locking fold, not reaching dorsal margin (fig. 35), locking fold sharply elevated above hemitergite surface, strongly convoluted, foot-shaped ventrally and extending below ventral hemitergite margin (fig. 35), margin constricted inward at dorsal connection with subapical notch, tuberculate area large, subquadrate, extending from base of tuft of black hair, diagonally upward and anteriorly, not reaching dorsal margin; proctiger broad dorsally, margins widest postmedially, shallowly constricted toward base, base widely expanded into membranous area, margins moderately constricted posteriorly, then prominently widened to lateral arms, lateral arms extending laterally at a 90-degree angle from longitu-

dinal axis of proctiger, margin thickened, evenly rounded ventrally and slightly anteriorly, dorsal opening between bases of lateral arms rounded, acutely angulate on each side of apical opening, posterior arms originating ventrally on lateral margins of apical opening, extending slightly downward then prominently posteriorly at a slight angle from each other, sharply angulate ventrally at apex, extending downward on each side of aedeagus; claspettes bent sharply upward at a 45 degree angle from near base to angulate apex, inner margin densely clothed with golden pile, subapical lobes moderately long, straight, clavate, surface with few bristle-like short golden hairs, outer margin bare except for sparse tuft of long golden hairs at base (fig. 55); interbasal fold deeply biemarginate apically in dorsal margin, median separation golden pilose apically. Length 19.1 mm.; mesonotal width 4.4 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The abdomen is dark gray pruinose, segments two and three with dorsolateral median black triangular spots and faint dark lateral areas near pleural suture. Head with more tan pruinosity and brown pilosity dorsally. Anterior femoral macrochaetae primarily white. Length 19.2 mm.; mesonotal width 4.8 mm.

TYPE MATERIAL: Holotype male, allotype female, 46 male, three female paratopotypes collected 3 miles south of Lewiston, Nez Perce County, Idaho, August 12, 1969 by W. F. Barr, J. Bigelow, M. Mortenson, M. Cazier.

PARATYPES: Idaho: Nez Perce County: 13 miles northwest Lewiston, August 12, 1969, W. F. Barr, J. Bigelow, M. Mortenson, M. Cazier, 24 males, 28 females; 1 mile south Lewiston, August 18, 1967, R. L. Westcott, one female. Idaho County: 3 miles south Whitehead, August 8, 1958, A. R. Gittins, one female. Canada: British Columbia: East side Osoyoos Lake, August 14, 1969, J. Bigelow, M. Mortenson, M. Cazier, 24 males, 10 females. Washington: Asotin County: 2 miles west Clarkston, August 10, 1967, R. L. Penrose, three males, two females. Yakima County: Yakima, July, 1958, D. Bishop, one male; 5 miles southwest Granger, August 2,

1941, Reeves and Brookman, one male; Sunnyside, August 8, 1941, Reeves and Brookman, one female. Franklin County: Kahlottus Road, 3 miles east Pasco, August 15, 1969, J. Bigelow, M. Mortenson, M. Cazier, nine males, two females. Okanogan County: At 6.7 miles north Manse, August 14, 1967, J. Bigelow, M. Mortenson, M. Cazier, two males, two females. Oregon: Gilliam County: Blalock, August 7, 1967, R. L. Westcott, two males, three females; Arlington, September 2, 1923, Carl D. Duncan, one female. Umatilla County: No location, August 1, 1960, R. L. Williamson, one male. California: Siskiyou County: 7 and 10 miles northeast Weed, July 30, 1966, August 7, 1958, J. Wilcox, J. Powell, five males; Lower Klamath Lake, August 10, 1968, Joe Schuh, one female; Hamburg, August 18, 1950, W. C. Bentinck, three males, one female. Mendocino County: Hopland, September, 1953, E. I. Schlinger, one female. Sonoma County: Hacienda, August 9, 24, 27, 1962, September 4, 1960, C. Slobodchikoff, 23 males, four females. Solano County: Putah Creek, 7 miles west Winters, August 20, 1967, R. F. Denno, one male, one female. Colusa County: Colusa, August 10, 15, 1955, August 1, 1957, September 1, 1957, M. Wasbauer, Don Burdick, R. O. Schuster, six males, three females. Yolo County: 1 mile south Davis, July 30, 1967, August 17, 1969, R. F. Denno, nine males, two females; Davis, August 7, 1953, August 14–21, 1955, August 3, 4, 6, 13, 1955 and 1956, August 12, 1962, July 26, 1965, August 20, 1970, July 24, 1961, E. I. Schlinger, A. T. McClay, R. M. Bohart, J. C. Downey, R. C. Bechtel, M. E. Irwin, C. R. Kovacic, L. R. Nault, 12 males, 12 females; Putah Canyon, August 20, 1955, August 1, 1956, J. C. Downey, R. M. Bohart, three males, four females. Alameda County: Tesla Road, July 25, 1957, D. Rentz, one female. Contra Costa County: Antioch, August 21, 1948, August 8, 1952, August 5, 1976, August 19, 1965, September 8, 1948, September 1, 1965, August 25, 1955, P. D. Hurd, J. W. MacSwain, M. Wasbauer, J. G. Rozen, C. D. MacNeill, W. W. Middlekauff, J. Powell, 13 males, three females; Santa Cruz County: Santa Cruz, August 20, 1964, C. R. Kovacic,



FIG. 3. Habitat *Apiocera barri*. Osoyoos Lake, British Columbia, Canada.

one male, one female. Merced County: Merced Falls, September 3, 1955, R. M. Bohart, four males, three females. Santa Barbara County: 8 miles west Cachuma Lake, July 6, 1959, P. E. Paige, one male, one female; Los Prietos, July 12, 1965, J. Powell, one male; 2 miles east Solvang, June 28, 1965, J. Powell, two males; New Cuyama, July 24, 1976, James O'Grady, three males.

Holotype male, allotype female and paratypes deposited in the American Museum of Natural History, New York. Paratopotypes and paratypes in the collections of Arizona State University, Tempe; and the University of Idaho, Moscow. Paratypes are deposited in the collections of the University of California, Berkeley and Davis; James O'Grady, Tucson, Arizona; Joe Wilcox, Anaheim, California; the California Academy of Sciences, San Francisco; and the Florida State Collection of Arthropods, State Plant Board, Gainesville.

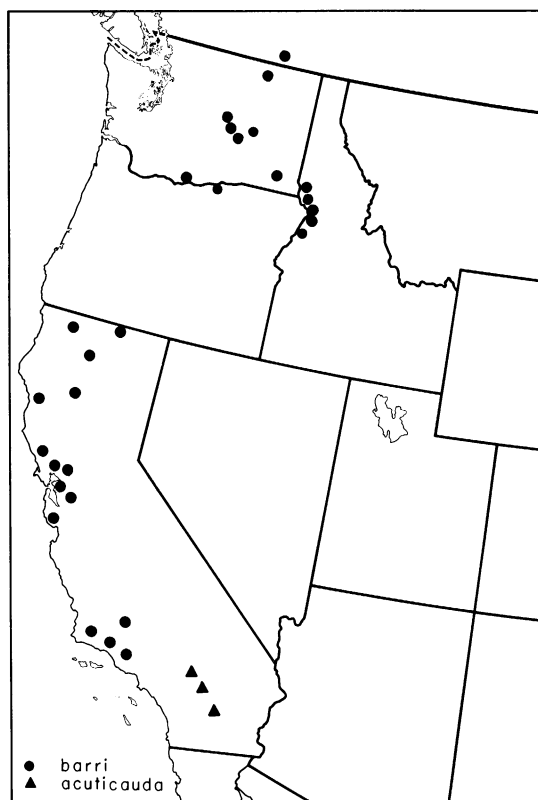
ETYMOLOGY: The species is named in honor of Dr. William F. Barr, University of Idaho, Moscow in appreciation for material loaned during these studies and for his assistance in collecting apiocerids in Idaho.

ECOLOGY: The type series was collected on a sandy, weedy bar on the shore of the Snake River on which there were a few willow trees (*Salix* sp.). The flies were running and flying in the shade of the willows and seemed to prefer depressions in the sand. At 13 miles northwest of Lewiston the habitat and behavior was the same as above. At Kahlotus road the males were found on the blacktop road, whereas the two females were in sand blowouts adjacent to the road. The specimens from 6.7 miles north of Manse were found in depressions in sandy hills where the plant cover was primarily *Atriplex* sp. which afforded shade for the flies. At Osoyoos Lake the specimens were found on sandy and dusty roads, sandy hillsides, and on moist sand in a creek bed (fig. 3). The specimen from Umatilla bears a note to the effect that it was collected from "Bitter brush." The female specimen from Yakima was evidently collected as prey of an unknown species of robberfly belonging to the genus *Promachus*.

VARIABILITY: In the series of 293 specimens, 201 males and 92 females, of which 141 males were dissected, there was consid-

erable individual variability in a few samples and some geographical trends that do not appear to represent subspecies. In the samples from Idaho, Washington, British Columbia, Oregon, and northern California there is little variability in any major characteristics, especially in the internal terminalia structures. In some males the tuft of black bristle-like hairs at the base of the locking fold extend diagonally upward and posteriorly to the submarginal black hairs. The macrochaetae on the outer margin of the anterior femora vary from being all black to being predominantly white. In many males the locking fold extends posteriorly beyond the posterior hemitergite margin as well as to or below the ventral margin. In a few specimens the claspettes extend vertically from the base but this appears to be a distortion resulting from dissection and does not affect the distinctive characteristics of the ventral lobes. In one specimen from Umatilla, Washington, the long recumbent hairs on the median projection of the ninth sternite are white rather than the characteristic black. In one of the females there is a small dorsolateral dark spot on abdominal segment four in addition to those on two and three. Many females are lighter in color than the males and have their mesonota light gray and tan pruinose. They may also have a few white hairs mixed with the black basal costal wing hairs.

In specimens from Antioch, central California, the abdominal markings are variable. Some specimens have the pattern and variability of the northern and more southern samples, whereas others have dorsolateral longitudinal gray vittae dividing the black transverse vittae on segments two through four. Every gradation in between these two extremes is evident in the sample of 13 males. Also, there appears to be a slight reduction in size in this sample and samples from Davis as compared with those from more northern and some southern localities. In some specimens from scattered locations in central California the long pile of the basal tuft on the outer margin of the ventral lobe of the claspettes is black or brown rather than golden. This variation was not found in the samples from the northwestern states. In



MAP 2. Distributions of *Apiocera* sp.: *A. barri*, *acuticauda*.

only one sample from New Cuyama was there any significant variation in the internal male terminalia structures. In the three specimens from this location the posterior arms of the proctiger extended downward and posteriorly from their base and are shallowly S-shaped. The horizontal extension of these arms, as in all other samples, is missing in these three specimens. However, in the main distinguishing feature of this species, the ventral lobe of the claspettes, the three specimens are identical with all other specimens. Also, they have the same bristle pattern on the inside hemitergite surface and the same extensive locking folds. In size, abdominal pattern, color, and other features they resemble the type series from Idaho.

RELATIONSHIPS: *Apiocera barri* (map 2) can be separated from all other known

species by its long straight parallel-sided or clavate ventral lobes of the claspettes, the surface of which is sparsely clothed with short bristle-like hairs and the outer margin has only a basal tuft of long, usually straight, hair (fig. 55). From *beameri* (map 9), with which it occurs sympatrically at New Cuyama, it is easily separated by its shorter and darker abdominal pile, by having the terminalia closed ventrally between the dististyles (see fig. 14), by its biemarginate interbasal folds (see fig. 38) and many other differences. *Apiocera barri* has, until now, been masquerading under *haruspex haruspex* (map 4) with which it bears a strong superficial resemblance. However, *haruspex haruspex* lacks the lateral arms on the proctiger; the ventral lobes of the claspettes are wide at the base, narrowing to an acute apical point, the surface is golden pilose and the outer margin has a dense row of long curved hairs from base to apex (fig. 53). *Apiocera barri* occurs sympatrically at Antioch with *chrysolasia* (map 1) which can be distinguished from both *barri* and *haruspex haruspex* by its rough dentate outer margin of the lateral proctigeal arms (fig. 79), by its short straight nonparallel-sided ventral lobes of the claspettes. From *barri* it can be further separated by the long curved golden pile on the outer edge of the ventral lobes and by its short interlocking folds which do not reach the ventral hemitergite margins (see fig. 33).

9. *Apiocera bibula*, new species

Figures 75, 99; Map 10

DIAGNOSIS: Medium-sized, narrow; pteropleura bare, gray pruinose in front of metathoracic spiracles; dististyles closed ventrally from transverse incisions in inner margin posteriorly to broadly divergent apices, without subapical flare of long hair; posterior tarsal pulvilli moderately broad, little more than half as long as claws; abdominal dark markings on segments two through four in transverse bands and spots including middorsal area (fig. 99); hind tibial macrochaetae black; hemitergites with shallow obtuse subapical notch in posterior margin; proctiger not Y-shaped apically; locking fold weakly convoluted, not extending ventrally to hemiter-

gite margin; ventral lobes of claspettes pilose; dorsolateral apical arms of proctiger not or but little produced beyond apex of subapical dorsal opening (fig. 75); costal wing vein completely or primarily black pilose basally; outer margin of lateral apical proctiger arms without subdorsal indentations (fig. 75); long hairs on median projection of ninth sternite usually all black.

DESCRIPTION: Male: Head with front white pruinose and pilose below median ocellus, yellowish pruinose dorsally, brown pilose between ocelli and on and behind vertex; antennal segments one and two dark, sparsely white pruinose, pilose and macrochaetose, segment three dark pruinose, ending in short acute tooth; palpi dark ventrally, yellowish apically, white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about half the width of a lateral ocellus; posterior head margin white pruinose, pilose and macrochaetose. Thorax with pronotal angles gray pruinose, black pilose and macrochaetose; mesonotum tan pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile brown, macrochaetae black; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle gray pruinose, bare except for few white hairs ventrally; wings with costal margin black pilose, few white hairs at base; scutellum light tan pruinose, black pilose, marginal macrochaetae black. Legs with coxae gray pruinose, white pilose and macrochaetose; anterior and middle femora white pruinose, primarily white pilose, primarily black macrochaetose, posterior femora gray pruinose, primarily brown pilose, black macrochaetose; tibiae sparsely gray pruinose, anterior and middle pairs primarily white pilose, black macrochaetose, posterior pair brown pilose, black macrochaetose; tarsi reddish brown, black pilose and macrochaetose; tarsal pulvilli moderately broad, little more than half as long as claws. Abdomen with segment one tan pruinose in basal one-quarter, brown pruinose in median third, extending from basal to apical margin, dorsolateral white pruinose areas reaching apical margin, pile white basally and medially,

black and white mixed laterally and apically, submarginal apical macrochaetae black; segments two and three with median transverse black vittae interrupted dorsolaterally by longitudinal gray and tan pruinose vittae (fig. 99), both segments have tan pruinose basal margins and black pile, the basal area of the median spot on segment two is brown pruinose; segment four is tan pruinose basally, white pruinose along narrow apical border, median black area not completely interrupted dorsolaterally by irregular tan longitudinal vittae (fig. 99), pile black; segment five white pruinose except for narrow longitudinal median line and small dorsolateral apical dark spot, pile primarily white; segments six and seven mottled gray and brown pruinose, primarily brown pilose; pleural area of segments two through four with brown pruinose, longitudinal narrow lateral marks along suture, pile primarily brown; sternites sparsely gray pruinose, white pilose. Terminalia: Exterior. Unicolorous reddish brown, sparsely black pilose; hemitergites with dorsal margin shallowly emarginate at apical third, posterior margin evenly rounded from shallow obtuse subapical notch to ventral margin, apex not strongly protruding beyond apical margin; dististyles evenly rounded apically, surface brown pruinose, without apical tuft of hair, ventral margin with broad, moderately deep postmedian incision, closed ventrally from postmedian incision to near apex; median projection of ninth sternite flat, not overlapping dististyles laterally, basal areas on each side of narrow median projection densely clothed with long and short black pile, subapical and median areas clothed with long black pile reaching posteriorly to apical edge of incision in margin of dististyles. Terminalia: Interior. Hemitergites with sparse black pile along dorsal margin from near emargination posteriorly to apex, moderately dense short black hairs extending from dorsal margin diagonally downward along base of locking fold to about middle of base, locking fold sharply elevated above hemitergite surface, extending horizontally to it to postmedian shallow convolution, surface smooth, ventral margin not extending to ventral hemitergite margin, tu-

berculate area small, oblong, in upper third of hemitergite, posterior to and below emargination in dorsal margin; proctiger gradually widened from middle anteriorly to expanded base in membrane, shallowly constricted at apical third, gradually widened to lateral arms, lateral arms only slightly expanded laterally, projecting almost straight down from dorsomedian apical opening, posterior margins of opening terminating in short inward pointing blunt spines (fig. 75), subdorsal lateral arms extending downward and slightly posteriorly from each lateral side of the opening downward on each side of aedeagus (fig. 75); claspettes nearly straight from base to apex, upper margin moderately densely golden pilose, apex straight, evenly rounded, subapical ventral lobes long, straight, surface sparsely golden pilose, apical edge in basal half with row of long, curved black hairs; interbasal folds deeply biemarginate apically in dorsal margin, median separation golden pilose. Length 18.3 mm.; mesonotal width 4.5 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The body is light tan, the abdominal markings are elongate dorsolateral black spots on segments two and three, brown on segment four. The pile on the base of the costal wing vein is primarily white as are the macrochaetae on the outer edge of the anterior femora. The posterior head surface has six black macrochaetae in addition to the white and there is one white macrochaeta among the black ones on the mesonotal margin. The legs are pale reddish brown, the tarsal pulvilli are slightly smaller than in the male and the macrochaetae on the posterior femora are primarily white. Length 18.2 mm.; mesonotal width 4.5 mm.

TYPE MATERIAL: Holotype male, allotype female, 13 male and 22 female paratopotypes collected at San Juan, Baja California Sur, Mexico, June 29, 1968 by N. Leppla, J. Davidson, J. Bigelow, M. Bentzien, W. Fox, S. Williams and M. Cazier. Three male and four female paratypes were collected 5 miles west of San Miguel Comodu, Baja California Sur, Mexico, July 3, 1968 by the same collectors as the primary types.

Holotype male, allotype female in the collection of the American Museum of Natural History, New York. Paratopotypes and paratypes in the collection of Arizona State University, Tempe.

ETYMOLOGY: From the Latin *bib* and *ula*, meaning drinking which is descriptive of the behavior of this species at both locations.

ECOLOGY: The specimens from San Juan were collected as they came into a moist, sandy area next to a spring seepage. The area was open, the sand was in between numerous small to medium rocks and there were only a few small annual plants present. At San Miguel Comondu the specimens were found on moist soil around pools in a river bottom. At both locations the flies were placing their fleshy mouthparts on the dampness and appeared to be drinking.

VARIABILITY: In the series of 44 specimens, of which 10 males were dissected, there was comparatively little variability in any of the major characteristics. In one specimen there were two black macrochaetae on the posterior coxae. The pile on the base of the costal wing vein varies from being all black to nearly all white. The black maculations on segments three and four vary from being completely interrupted by dorsolateral longitudinal white vittae to being barely interrupted and in one specimen the black on segment four is not interrupted.

RELATIONSHIPS: *Apiocera bibula* (map 10) appears to be most closely related to *volucra* (map 3) and *horticolis* (map 6) but can be separated from both by having the subapical notch on the posterior hemitergite margin obtuse rather than acute and by the ventrally produced subdorsal arms on the proctiger (fig. 75). *Apiocera bibula* does not have the thickenings or the indentations on the posterior margin of the lateral proctigial arms as in *chrysolasia* (fig. 79). Also, the long hairs on the median projection of the ninth sternite are all black in *bibula* and all golden in *ogradii*. *Apiocera bibula* (map 10) was collected sympatrically with two specimens of *horticolis* (map 6) but can be separated from it as given above. In addition to occurring geographically, ecologically, and chronologically together with *horticolis* it is similarly as-

sociated with *davidsonorum* (map 7) at San Juan. It can be separated as given under *davidsonorum*.

10. *Apiocera volucra*, new species

Figures 76, 100; Map 3

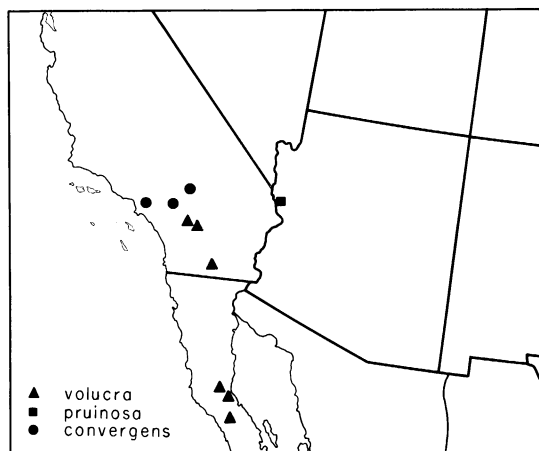
DIAGNOSIS: Medium- to large-sized, narrow; pteropleura bare, gray pruinose in front of metathoracic spiracles; dististyles closed ventrally from wide transverse incision posteriorly to near apex, without subapical flare of long hair; posterior tarsal pulvilli broad, more than half as long as claws; abdominal black markings on segments two through four in transverse bands including middorsal area (fig. 100); posterior tibial macrochaetae black; hemitergites with deep, acute subapical notch in posterior margin, margin obliquely truncate; proctiger not Y-shaped apically, dorsolateral apical arms not extending posteriorly beyond apex of subapical dorsal opening (fig. 76); locking fold with single basal convolution, not extending ventrally to hemitergite margin; ventral lobes of claspettes golden pilose; costal wing vein black pilose basally; outer margin of lateral apical arms of proctiger without subdorsal indentations (fig. 76); long hairs on median projection of ninth sternite primarily black; ventral lobes of claspettes medium to long and straight; dark transverse bands on abdominal segments three and four not interrupted dorsolaterally (fig. 100).

DESCRIPTION: Male: Head with front white pruinose and pilose below median ocellus, vertex white pruinose, white pruinose and black and white pilose between dorsal and median ocelli; antennal segments dark, segments one and two white pruinose, pilose and macrochaetose, segment three sparsely white pruinose, ending in short acute tooth; palpi pale yellowish, white pilose; compound eyes separated from lateral ocelli on vertex by less than the width of a lateral ocellus; posterior head margin white pruinose, pilose, and macrochaetose. Thorax with pronotal angles gray pruinose, black pilose, and macrochaetose; mesonotum gray pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and sub-

marginal hairs brown and white mixed, macrochaetae black; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle gray pruinose, bare except for few white hairs at bottom; scutellum gray pruinose, brown pilose, marginal macrochaetae black; wings with costal margin black pilose throughout. Legs with coxae gray pruinose, white pilose and macrochaetose; femora piceous sparsely gray pruinose, anterior and middle pairs primarily white pilose, anterior femoral macrochaetae black and white mixed, posterior femora brown pilose, black macrochaetose; tibiae light reddish brown, black macrochaetose, anterior and middle pair white pilose, posterior pair brown pilose; tarsi light reddish brown, hairs brown, macrochaetae black; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with segment one gray pruinose except for median light brown pruinose area, white pilose except for sparse brown apical hairs, more abundant laterally, subapical row of macrochaetae black; segment two with wide median transverse black vittae, expanded medially to basal and apical margins, dorsolateral basal and apical areas gray pruinose, pile brown; segment three black from apical margin to basal third, reaching basal margin medially, gray dorsolateral areas continuous with apical gray areas on segment two, brown pilose (fig. 100); segment four black except for narrow gray pruinose apical margin and narrow dorsolateral gray pruinose areas, pile brown (fig. 100); segments five through seven irregularly gray pruinose, faint dorsal median longitudinal dark line and dorsolateral brown areas on apical margin, pile primarily white; pleural areas gray pruinose, white pilose, segments two through four with lateral dark areas increasing in size apically, connected to dorsal dark markings on segment four; sternites reddish brown, irregularly gray pruinose, white pilose. Terminalia: Exterior. Dark reddish brown throughout, sparsely black pilose; hemitergites with dorsal margin shallowly emarginate at apical third, posterior margin obliquely truncate, subapical notch deep and acute; dististyles acutely rounded apically, ventral margin with wide deep postmedian incision,

closed ventrally from incision to near apex; median projection of ninth sternite flat, not overlapping dististyles laterally, basal areas on each side of narrow median projection densely clothed with long and short black hair, median projection with long hair extending posteriorly to incision in dististyles, long hairs bicolored, black basally, pale apically. Terminalia: Interior. Hemitergites with sparse black pile along dorsal margin in apical third, basal attachment of locking fold with diagonal row of sparse short black hairs extending to dorsal margin; locking fold sharply elevated above hemitergite surface, extending horizontally to it, deeply convoluted near base, not projecting ventrally to hemitergite margin, tuberculate area small, extending from near base of locking fold diagonally forward and upward, not reaching dorsal margin; proctiger slightly expanded basally into membranous area, lateral margins shallowly constricted about apical third, expanded posteriorly to lateral descending arms, median apical dorsal opening shallow, posterior lateral edges formed by lateral arms, ventral median projections curved posteriorly and downward on each side of aedeagus, posterior margin of lateral arms rounded, without irregularities (fig. 76); claspettes nearly straight from base to bluntly rounded apex, inner margin concave, upper margin moderately clothed with golden pile, subapical ventral lobes long, straight and sharply pointed, surface sparsely golden pilose, outer margin with row of black hairs, long and curved at base, becoming shorter and straight at apex; interbasal fold deeply biemarginate apically in dorsal margin, median separation golden pilose apically. Length 19.7 mm.; mesonotal width 4.7 mm.

FEMALE: Similar to the male except for the secondary sexual characteristics. The head and thorax are primarily light tan pruinose, the abdomen primarily gray pruinose. The pile on the vertex of the head and between the ocelli is black as are four of the median macrochaetae on the posterior head margin. Abdominal segments two and three have dorsolateral median black subtriangular maculations. The costal wing veins are primarily black pilose but a few white hairs are mixed



MAP 3. Distributions of *Apiocera* sp.: *A. volucra*, *pruinosa*, *convergens*.

with the black at the base. Length (abdomen extended) 22.3 mm.; mesonotal width 4.6 mm.

TYPE MATERIAL: Holotype male and seven male paratopotypes were collected at Las Arrastras, Baja California Norte, Mexico, June 15, 1968 by N. Leppla, J. Davidson, J. Bigelow, M. Bentzien, W. Fox, S. Williams, and M. Cazier. Allotype female and one male paratype were collected at Arroyo de Calamajue, Baja California Norte, Mexico, June 16, 1968 by the same collectors as the holotype.

PARATYPES: Mexico: Baja California Norte: 5 miles south Arroyo de Calamajue, June 16, 1968, by same collectors as the holotype, one female. United States: California: San Diego County: Palm Grove, Palm Canyon, Anza-Borrego State Park, June 5, 1970, L. (Welch) Draper, O. Francke, M. Cazier, one male; South Indian Canyon, July 12, 1948, G. A. Marsh, two males, one female; 6 miles east Banner, June 26, 1963, D. C. Baerg, one male. Riverside County: Cathedral City, July 16, 1950, J. W. MacSwain, one male; Magnesia Canyon, July 9, 1950, June 28, July 2, 1952, J. Linsley, D. Shepherd, B. Tinglof, S. Miyagawa, A. T. McClay, A. A. Grigarick, H. S. Mathis, D. S. Thompson, J. H. Nakata, E. Benjamini, R. M. Bohart, 43 males.

Holotype male, allotype female in the collection of the American Museum of Natural History, New York. Paratopotypes and paratypes in the collections of the University of California at Berkeley, Davis and Los Angeles; Arizona State University, Tempe; and the California Academy of Sciences, San Francisco.

ETYMOLOGY: Modified from the Latin *volucra*, meaning swift flying which describes the behavior of this species at the type locality and the site of the allotype collection.

ECOLOGY: The specimens from the type locality at Las Arrastras were collected as they came into a cattle watering trough and moist adjacent dirt, presumably to drink. The eight specimens were taken sympatrically with 319 specimens of *spectabilis* at this location. At Arroyo de Calamajue they were found on moist spots along and adjacent to a small alkaline stream, again in association with *spectabilis*. The single male from Palm Canyon was found on wet black ashes above a small waterfall on the edge of the burned-out upper grove area. The specimen seemed unaffected by if not actually attracted to the moist ashes and appeared to be drinking as were 48 specimens of *spectabilis*. No information is available on the breeding sites of either *volucra* or *spectabilis*.

VARIABILITY: In the 56 males and three females there was comparatively little variability in the major characteristics even though the geographical range is rather extensive (map 3). In the males, of which 27 had their terminalia opened, the primary variations were in the ventral lobes of the claspettes which ranged in size from medium to long and in the extent of apical expansion of the proctiger which was moderate to widely expanded anterior to the lateral arms. Unlike the holotype, all but three of the specimens had the legs unicolorous black to piceous. In two specimens the median black maculation on segment two had the middorsal area golden pruinose and a few specimens showed traces of golden pruinosity in this area. In two specimens the pile on the vertex and between the ocelli on the head were white instead of brown or black and in six

specimens segment two of the antennae had from one to six black macrochaetae mixed in with the white. In three specimens the acute notch in the posterior hemitergite margin was small and indistinct in the bottom of a large obtuse indentation of the posterior margin in the subdorsal area and in one specimen the notch was obliterated by this indentation. In three specimens there were a few white hairs at the extreme base of the costal wing vein and in one specimen this area was primarily white pilose, most specimens had the pile all black. The primary variation in the females was in size which in the two paratypes that had their abdomens unextended ranged from 17.4 to 19.2 mm. and the mesonotal width from 4.3 to 4.5 mm.

RELATIONSHIPS: *Apiocera volucra* appears to be most closely related to *horticolis* but can be separated from it by its medium to long ventral lobes of the genital claspettes and the posterior marginal long curved black hairs. In *horticolis* the lobes are short and the long brown hairs are on the basal half and may be tuftlike in arrangement. In both *horticolis* and *bibula* most of the specimens have the dark abdominal markings interrupted dorsolaterally by longitudinal gray pruinose vittae. In *volucra* no specimens have this condition (fig. 100). In addition, *bibula* has an obtuse subapical notch in the posterior hemitergite margins which are evenly rounded apically. In *volucra* the notch is acute or occasionally absent and the posterior margins are obliquely truncate. From *chrysolasia*, *volucra* can be separated by having the outer margins of the lateral arms of the proctiger smooth and evenly rounded (fig. 76) rather than indented, thickened and rugose (fig. 76).

Superficially *volucra* (map 3) resembles *spectabilis* (map 10), so closely in fact that at the three locations in which they were found sympatrically, as mentioned earlier, the collectors failed to recognize that two species were involved. Actually they are only distantly related as one would anticipate from their sympatric occurrence while maintaining specific distinctness. *Apiocera spectabilis* has long hair on the pteropleura anterior to the metathoracic spiracles (fig. 12),

the dorsocaudal angle of the mesopleura has both hair and macrochaetae (fig. 12), the dististyles of the terminalia are widely open ventrally (fig. 13), the hemitergites have no subapical acute notch in the posterior margin, and the internal terminalia structures are entirely different. *Apiocera volucra* has none of the above features and is generally smaller in size. At the Palm Canyon location a third species was found masquerading in the series of *spectabilis* which contained the single *volucra*. Six males of *alleni* (map 12), previously known only from the male holotype, were found mixed in the series. In size and abdominal maculations they closely resemble both *spectabilis* and *volucra*. However, *alleni* can be separated from *volucra* by the same set of differences given for *spectabilis* and in addition it has the median projection of the ninth sternite projecting posteriorly beyond the transverse portions of the interbasal folds which project into the ventral opening between the dististyles (fig. 23). From *spectabilis*, *alleni* can be further distinguished by lacking the flat lateral membranous area on the posterior projection of the ninth sternite (fig. 13).

In addition to occurring geographically, ecologically, and chronologically together with *alleni* and *spectabilis* at Palm Grove (maps 3, 10, 12), *volucra* is sympatric with *wilcoxi* (map 1) at Magnesia Canyon and with *spectabilis* at 5 miles west of Arroyo de Calamajue. It can be separated from *spectabilis* as given above and from *wilcoxi* by having no spines on the dorsoapical area of the proctiger (fig. 76), by its short ventral subapical lobes of the claspettes and by its biemarginate apical inner interbasal folds (see fig. 38). In *wilcoxi* the dorsoapical area of the proctiger is spinose, the ventral subapical claspette lobes are long and sinuous (fig. 54) and the apex of the inner interbasal folds are shallowly emarginate.

11. *Apiocera parahydra*, new species

Figures 4, 74; Map 13

DIAGNOSIS: Small-sized, narrow; pteropleura bare or occasionally with one or two inconspicuous white hairs, gray pruinose in

front of metathoracic spiracles; dististyles closed ventrally from narrow transverse incisions posteriorly to near apex, without subapical flare of long hairs; posterior tarsal pulvilli broad, more than half as long as claws; abdominal black markings in transverse bands including middorsal area; macrochaetae on hind tibiae black; hemitergites with or without shallow subapical notch; abdominal segments five and six without middorsal dark line or dorsolateral dark markings; compound eyes separated from lateral ocelli on vertex by less than the diameter of a lateral ocellus; dark middorsal transverse markings on abdominal segments three and four grading from brown basally to dark brown apically, occasionally narrowly black apically or black laterally toward apex.

DESCRIPTION: Male: Head with front white pruinose and pilose below median ocellus, vertex yellowish pruinose, brown pilose between ocelli; antennal segments one and two gray pruinose, white pilose, and macrochaetose, segment three light brown in basal one-quarter, dark brown to black in apical three-quarters, ending in short acute tooth; palpi dark in basal half, yellowish in apical half, white pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by less than the width of a lateral ocellus; posterior head margin light tan pruinose dorsally, white pruinose ventrally, white pilose throughout, macrochaetae white except for two black on left side at top. Thorax with pronotal angles light tan pruinose, brown pilose, black macrochaetose; mesonotum tan pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile brown, macrochaetae black except for one white on the left posterior angle; mesopleura gray and light tan pruinose, upper episternal area sparsely pilose posteriorly, remainder bare, dorsocaudal angle light tan pruinose, bare except for few hairs near bottom above junction with pleural suture; wings with costal margin black pilose except for few white hairs at extreme base; scutellum brown pruinose discally, gray pruinose along posterior margin, white and brown pilose, marginal macrochaetae black. Legs with coxae white

pruinose, pilose and macrochaetose; femora black, densely white pruinose, anterior and middle pair brown and white pilose, primarily white macrochaetose, posterior pair brown pilose, primarily black macrochaetose, tibiae on anterior and middle pair dark reddish brown, posterior pair piceous, all tibiae gray pruinose, anterior and middle pair brown and white pilose and macrochaetose, posterior pair brown pilose, black macrochaetose; anterior tarsi brown and white pilose, black macrochaetose, middle and posterior pair brown pilose, black macrochaetose; tarsal pulvilli moderately broad, two-thirds as long as claws. Abdomen with segment one brown pruinose in basal third, vitta expanded medially reaching posterior margin in middle third, white pruinose dorsolateral round spots reaching apical margin, pile on brown maculations primarily brown, on white maculations and lateral areas primarily white, subapical margin with row of black macrochaetae; segment two brown pruinose in basal two-thirds, not reaching apical margin on dorsum, posterior margin of brown vitta darker brown and biemarginate, apical margin white pruinose, expanded basally on each side of middle and in pleural area, surface rather densely white pilose basally, sparsely brown pilose apically; segment three brown pruinose in basal half, grading apically into dark brown and black reaching posterior margin laterally, median one-third of apical margin irregularly narrowly white pruinose, surface sparsely brown pilose; segment four with brown basal pruinose vitta extending to narrow gray marginal vitta medially, darker brown to black areas dorsolateral and postmedian, pile sparse, brown; segments five and six white pruinose, primarily white pilose, few brown hairs near apical margins; segment seven brown pruinose, brown and white pilose; pleural areas sparsely gray pruinose, white pilose, dorsal dark vittae not reaching pleural suture; sternites sparsely gray pruinose, long sparse white pilose. Terminalia: Exterior. Bicolored, piceous basally, hemitergites with median piceous line extending from base to apical third, gray pruinose, dististyles with piceous subdorsal line extending to apical

third, apices and areas around dark lines reddish brown, sparsely black pilose throughout; hemitergites with dorsal margin shallowly emarginate at apical third, posterior margin with shallow subapical notch, ventral margin straight, posterior margin angulate dorsally to notch, apex not strongly protruding; dististyles slightly angulate apically, without tuft of long hair, ventral margin with narrow shallow postmedian incision, closed ventrally from postmedian incision to near apex; median projection of ninth sternite flat, not overlapping dististyles laterally, basal areas on each side of narrow median projection densely clothed with long and short black pile, extending posteriorly almost to marginal incision in dististyle margin, median projection sparsely clothed with long black hair extending posteriorly almost to marginal incision in dististyles. Terminalia: Interior. Hemitergites with sparse black pile along dorsal margin, sparse black hair on inner subapical margin, dense tuft of short black erect hair on surface at midbase of locking fold, locking fold sharply elevated above hemitergite surface, extending horizontally to it and not projecting below ventral hemitergite margin, tuberculate area small, oblong, slightly anterior and beneath emargination in dorsal margin; proctiger slightly constricted basally, expanded into membranous area, strongly constricted apically to median subapical opening separating posterior lateral projections, dorsal opening elongate posteriorly, margins evenly rounded, ending posteriorly in two small acute dorsal projections, lateral arms extending downward from constriction, expanded surface extending posteriorly and downward from apex of dorsal opening on each side of aedeagus, posterior ventral ends sharply pointed (fig. 74); claspettes slightly curved from base to apex, inner margin concave, upper margin sparsely golden pilose, nonmembranous, apex evenly rounded, not extending downward, subapical ventral lobes short straight thick, pointed apically, upper surface sparsely golden pilose, lower outer margin evenly clothed with long curved black hair from base to apex; interbasal fold deeply biemarginate apically in dorsal margin, me-

dian separation golden pilose. Length 15 mm.; mesonotal width 3.5 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The body is light tan, brown and gray pruinose. The head front is tan pruinose, pile below ocelli golden, between ocelli and on the vertex brown. Mesonotum tricolored, golden pruinose anteriorly, markings brown pruinose laterally bordering inner gray pruinose median stripe, discal pile brown, lateral pile and macrochaetae black and white mixed. Wings with basal portion of costal wing vein white pilose, median and apical portion black and white pilose. Legs testaceous, white pruinose, pilose, and macrochaetose except for posterior tibiae which have both black and white macrochaetae, tarsi white pilose, black macrochaetose. Abdominal segments two and three with triangular shaped dark dorsolateral spots and middorsal dark longitudinal lines. Length 15 mm.; mesonotal width 4 mm.

TYPE MATERIAL: Holotype male, allotype female, 160 male and 51 female paratopotypes collected at Lukachukai, Apache County, Arizona on June 24, 25, 30 and July 2-4, 7, 8, 12, 1972 by J. Bigelow, O. Francke, M. G. Cazier, M. A. Cazier. Only those specimens collected along Lukachukai Creek are included in the paratopotype series even though three other locations are close by.

PARATYPES: Arizona: Apache County: Lukachukai July 8, 1972, J. Mitchell, one female; Tohotso Creek, 2 miles east Lukachukai, July 7, 1972, O. Francke, M. G. and M. A. Cazier, one male; Rodeo grounds, Lukachukai, June 24 and 25, 1972, L. Burroughs, J. Bigelow, M. Cazier, three males, seven females. Navajo County: 4 miles north of Kayenta, July 28, 1969, J. Bigelow, M. Mortenson, M. Cazier, four males; 15 miles north Kayenta, July 28, 1969, J. Bigelow, M. Mortenson, M. Cazier, one male, one female; 5 miles east Kayenta, July 14, 1967, J. H. and J. M. Davidson, M. Cazier, 21 males, five females; 16 miles northeast Kayenta, July 14, 1967, J. H. and J. M. Davidson, M. Cazier, four males and two females; 3 miles south Mexican Water, July 16, 1967, J. H.



FIG. 4. Habitat *Apiocera parahydra*. Monument Valley Headquarters, Navajo County, Arizona.

and J. M. Davidson, M. Cazier, six males; 6 miles east Mexican Water, July 16, 1967, J. H. and J. M. Davidson, M. Cazier, 33 males, four females; Monument Valley Headquarters, July 28, 1969, J. Bigelow, M. Mortenson, M. Cazier, six males, one female; 4 miles north Winslow, June 21, 1972, J. Bigelow, O. Francke, one teneral male; 1 mile northeast Winslow, June 25, 1972, O. Francke, M. G. Cazier, J. Bigelow, two males. Coconino County: Moenave, June 24, 25, 29, 1967, J. H. and J. M. Davidson, M. Cazier, 11 males. Utah: San Juan County: Monument Valley, July 16, 1967, W. F. Barr, four males, one female; Bluff, July 14–15, 1967, J. H. and J. M. Davidson, M. Cazier, seven males, one female; 4 miles east Bluff, July 29, 1969, J. Bigelow, M. Mortenson, M. Cazier, two males, one female; 2 miles southwest Bluff, July 15, 1967, J. H. and J. M. Davidson, M. Cazier, one female; 2 miles northeast Bluff, July 29, 1969, J. Bigelow, M. Mortenson, M. Cazier, 35 males, five females. Grand County: 3 miles south Moab, July 31, 1969, M. Mortenson, J. Bigelow, M. Cazier, 99 males, 35 females.

Holotype male, allotype female, parato-

potypes and paratypes in the collection of the American Museum of Natural History, New York. Paratypes in the collection of the University of Idaho, Moscow. Paratopotypes and paratypes in the collection of Arizona State University, Tempe.

ETYMOLOGY: From the Greek *para*, meaning beside or near and *hydra*, meaning water which amply characterizes the microhabitat of the paratopotypic series and that of most of the other samples.

ECOLOGY: The types and paratopotypes were collected along Lukachukai Creek where it traverses the north side of the town in a rather deep cut in the red sandstone. They were found on damp sand next to the small stream, in open sandy areas between sage-brush plants, *Artemisia tridentata* Nuttall, along both sides of the stream and beneath thistle plants, *Cirsium* species, under which the sand was stained dark by aphid honey dew. The flies were placing their mouthparts on this sweet material as if they were feeding. Specimens from the Rodeo grounds in Lukachukai were collected at artificially created wet spots in the sand next to the bleachers and were probably attracted

from the surrounding loose dune area. The specimen from Tohotso Creek was found along the sandy shore of the small stream. Specimens from the vicinity of Kayenta, Mexican Water and Monument Valley were taken along sandy roads and on dry consolidated dunes among sparse shrubs (fig. 4). The Moenave specimens were collected in sandy blowouts immediately adjacent to irrigation ditches filled with water and in a sandy seepage area around a spring. The specimen from 4 miles north of Winslow was found in a riparian community on the Little Colorado River flood plain about one-quarter of a mile from the present river channel. The tree cover consisted primarily of *Tamarix chinensis* Loureiro (= *T. pentandra* Pallas) and *Populus fremontii* Watson with an understory of numerous species of shrubs and herbs. The soil was a fine-grained alluvium with many cracks due to surface drying and the specimen was found in a small catch basin where it may have been visiting the cracks for moisture. At the location 1 mile northeast of Winslow, the specimens were found in a dune area on the west bank of the Little Colorado River. One specimen was found in a mudcracked basin at the base of a dune, whereas the second was found sitting on a lower branch of a Russian thistle, *Sal-sola kali* Linnaeus, on the edge of a mudcracked basin. Specimens collected at Bluff, Utah, were found in sandy areas adjacent to the San Juan River, whereas those from other areas near Bluff were found along sandy roads, on sand dunes and on bedrock in sand blowouts above and away from the river. At Moab, Utah, the long series was collected in two quite different ecological situations. About 30 of the 136 specimens were found on dry open loose sand between elevated hummocks of *Larrea tridentata* (De Candolle) Coville on the west side of U.S. route 160 near the entrance to the Moab race track. The remainder of the specimens were taken inside an enclosure next to the track, which was inactive at this time, on rocky loam soil densely covered with several species of weeds. A watering trough in the enclosure and the shade offered by the weeds may have attracted the specimens from the surround-

ing dune area but none were seen going to the trough and since they were so numerous among the weeds we did not bother to create an artificial wet spot.

VARIABILITY: In the series of 520 specimens, of which 143 males were dissected, there was considerable individual as well as geographical variability. Within the paratopotypical male series the pile on the costal wing vein varied from being all black to all white with most specimens having at least a few white hairs near the wing base. In one specimen the basal pile was golden. The macrochaetae on the posterior head surface were all white in most specimens, but a few had as many as 12 black ones in the dorsal area. In five specimens the middorsal stripe and dorsolateral dark markings were present on abdominal segments five and six and in three specimens the dark markings on segments two through four were partially divided on each side of the middle by longitudinal gray vittae. In three specimens the dark transverse vittae on segments three and four covered the middle half of the segments. In six specimens the compound eyes were separated from the lateral ocelli on vertex by the width of a lateral ocellus instead of less than the width. In four specimens the terminalia were gray pruinose and the subapical opening in the proctiger varied from being almost square, to triangular, to round, to oblong. The emargination in the dorsal hemitergite margin varied from being shallow to deep and in three specimens the posterior margin had no subapical notch. In many specimens the dorsocaudal angle of the mesopleura was pilose ventrally as a continuation of the pile along the posterior margin of the upper episternal area. No specimens had macrochaetae in this region. Six specimens had from two to five long white hairs on the pteropleura anterior to the metathoracic spiracles, whereas in most specimens it was bare. Among the 51 female paratopotypes, one specimen had the dorsolateral dark markings on abdominal segment three missing, seven specimens had an irregular indistinct dorsolateral dark area on segment four, and eight specimens had middorsal rounded dark basal spots on segments two and three. The ante-

rior and middle tibiae in six specimens had a few black macrochaetae, one specimen had black macrochaetae on the posterior femora, and all specimens had the tarsal pulvilli relatively narrow but two-thirds as long as the claws. In five specimens there were a few black hairs mixed with the white in the apical two-thirds of the costal wing vein. The pile and macrochaetae on the pronotum and mesonotum varied from being all white to all black with all intermediate conditions represented. The type and extent of the individual variability in the paratopotypes was representative of all the other samples except for the three discussed below.

In the northernmost sample of *parahydra* taken near Moab, Utah, the specimens have more extensive black areas on abdominal segments three and four and in some specimens these black markings are shiny and nonpruinose. In about one-quarter of the series the basal markings on abdominal segments three and four are gray instead of brown pruinose with many specimens intermediate. In the southernmost samples taken near Winslow, Arizona, the dark markings are light to dark brown rather than partially black and in two of the three specimens the terminalia are white pilose. In the 11 specimens from Moenave (near Tuba City) the abdominal dark markings vary from having no black to being narrowly black as in the paratopotypic series. Five of the 11 specimens have the terminalia white pilose.

RELATIONSHIPS: *Apiocera parahydra* (map 13) appears to be most closely related to *mortensoni* (map 13) but can be separated from it by the white pile on the basal half of the second abdominal segment, by lacking the dorsal and lateral dark markings on abdominal segments five and six, by the white macrochaetae on the anterior femora and the black areas on the abdominal segments two through four are narrower and less shiny. From *auripilosa* (map 11) with which it occurs almost sympatrically it is easily separated by having white instead of golden pile on abdominal sternites two through four, by having the terminalia closed beneath (see fig. 14) and by having brown pruinose areas on the dorsum of abdominal segments two

through four. *Apiocera voragocolis* (map 9) occurs about 100 airline miles northwest of Winslow at the junction between the Little Colorado and the Colorado rivers. Both locations are connected by the Little Colorado River and probably therefore by satisfactory habitats along this river. However, *parahydra* can easily be separated by having the terminalia closed ventrally (see fig. 14), by having brown pruinose abdominal markings and short subapical ventral lobes on the claspettes. So far as presently known, *parahydra* is allopatric with all the above species, although narrowly so with *auripilosa* in Apache County. *Apiocera parahydra* has been collected 3 miles south and 6 miles east of Mexican Water in July and *auripilosa* has been found at Mexican Water Camp Ground in June.

12. *Apiocera mortensoni*, new species

Map 13

DIAGNOSIS: Small-sized, narrow; pteropleura bare, gray pruinose in front of metathoracic spiracles; dististyles closed ventrally from narrow transverse incisions posteriorly to near apex, without subapical flare of long hairs; posterior tarsal pulvilli broad, more than half as long as claws; abdominal black markings in transverse bands including middorsal area; macrochaetae on hind tibiae black; hemitergites with shallow subapical notch; abdominal segments five and six with middorsal narrow longitudinal dark line and dorsolateral dark markings; claspettes with upper edge in distal half sparsely golden pilose internally; abdominal segment two with uninterrupted transverse basal brown vitta, median black vitta, apical margin gray pruinose; hemitergites with acute subapical notch.

DESCRIPTION: Male: Head with front white pruinose and pilose below, slightly yellowish toward vertex, vertex yellowish pruinose, brown pilose between the three ocelli; antennal segments one and two dark, densely white pruinose, white pilose and macrochaetose, segment three dark brown to black pruinose, ending apically in short acute tooth; palpi yellowish, white pruinose and

pilose; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by less than half the width of a lateral ocellus. Thorax with pronotal angles gray pruinose, brown pilose, black macrochaetose; mesonotum tan pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile mixed white and brown, macrochaetae black; mesopleura gray pruinose, sparsely white pilose below, sparsely brown pilose above, dorsocaudal angle gray pruinose, bare dorsally, ventral margin sparsely brown pilose, without macrochaetae; wings with costal margin black pilose throughout; scutellum with discal surface brown pruinose, apical margin gray pruinose, submarginal macrochaetae black. Legs with anterior and middle coxae gray pruinose, white pilose and macrochaetose, posterior coxae gray pruinose, white pilose, black and white macrochaetose; femora black, gray pruinose, white and brown pilose, black macrochaetose; tibiae and tarsi reddish brown, brown pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with segment one white pilose basally, black or brown pilose apically, subapical row of macrochaetae black, dense lateral pile mixed brown and white, brown pruinose in basal third and median third to apex of segment, dorsolateral elongate spots gray pruinose; segment two brown pilose dorsally, basal half brown pruinose transversely, median narrow black transverse vitta trilobed on posterior margin, not reaching apical margin of segment, apical third with white transverse vitta bilobed basally on each side of middle; segment three with wide basal transverse gray pruinose vitta interrupted medially by brown pruinose spot, wide median and postmedian black transverse vitta reaching posterior margin dorsolaterally and medially, median posterior projection with small marginal white pruinose spots on each side; segment four with lateral basal white pruinose spots continuing from segment three, narrow white pruinose apical border, remainder of segment black; segments five and six white pruinose except for narrow median and large

dorsolateral brown pruinose spots; segment seven brown pruinose dorsally; segments two and three with small brown pruinose lateral spots; segment four with large dorsal black vitta reaching lateral margin; abdominal sternites one through seven mottled gray pruinose, white pilose. Terminalia: Exterior. Piceous basally, reddish brown apically; hemitergites brown pruinose and pilose, dorsal margin sharply shallowly angulate at about apical third, posterior margin with acute subapical notch; dististyles black pilose, brown pruinose, apices evenly rounded, closed ventrally from postmedian incision in inner margin to apex, incision shallow and narrow; median projection of ninth sternite evenly rounded, not overlapping dististyles laterally, clothed laterally with long dense black hair extending almost to incision in dististyles, originating along posterior edge of ninth sternite, median projection clothed medially with long black hairs extending beyond incision in dististyles, projection obscured by hair. Terminalia: Interior. Hemitergites with tuft of short black hair on midbasal margin of locking fold, continuous with sparse black longer hair along subapical margin, tuberculate area small rounded, confined to upper third of hemitergite anterior to angulation in dorsal margin, locking fold prominent, extending outward from hemitergite surface and in part parallel with this surface, posterior ventral margin beginning on lower edge of subapical notch extending anteriorly subparallel to but inside ventral edge of hemitergite to rounded tip beneath short black hair tuft, anterior margin rounded inward and upward toward tuft, strongly angulate anteriorly beneath tuft, extending anteriorly to attachment to hemitergite almost directly below angle in upper hemitergite margin and in middle of hemitergite surface; proctiger with side margins subparallel medially, gradually expanded anteriorly, strongly constricted posteriorly in front of rounded subapical opening, lateral arms extending outward and downward from about middle of opening, apical arms extending apically and downward from each side of subapical opening, arms narrow, flattened laterally, extending downward on both sides

of aedeagus; claspettes straight ending posteriorly in bluntly rounded slightly enlarged tips, inner edges without membranous area, moderately densely golden pilose, subapical ventral lobes, short, stout and pointed, posterior lower edge clothed with long curved black hair from base to apex, hairs sparsely rather evenly spaced; inner interbasal folds deeply, obtusely biemarginate in upper apical margin, median narrow projection separating the deep grooves golden pilose. Length 16 mm.; mesonotal width 4 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The entire body is tan pruinose; the mesonotal macrochaetae are both white and black; the costal wing vein is black pilose except for basal area where the black hair is mixed with white; segments two through four on the abdomen have rounded median dorsolateral dark spots, segments two and three have faint dark middorsal spots; the legs are testaceous, anterior, middle legs and posterior femora white pruinose, pilose and macrochaetose, posterior tibiae brown and white pilose, black macrochaetose. Length 15 mm.; mesonotal width 4 mm.

TYPE MATERIAL: Holotype male, allotype female, 63 male and 29 female paratopotypes collected in Dixie State Park, Snow Canyon, Washington County, Utah, August 22, 1969 by J. Bigelow, M. Mortenson, and M. Cazier.

PARATYPES: Arizona: Coconino County: 8 miles southwest Cliff Dwellers Lodge, July 11, 1967, J. H. and J. M. Davidson, M. Cazier, one male; Cliff Dwellers Lodge, July 11, 1967, J. H. and J. M. Davidson, one male. Utah: Washington County: 3 miles northwest Leeds, July 3, 1966, W. F. Barr, seven males, one female; 5 miles southwest Shivwits, July 2, 1966, R. L. Westcott, E. J. Allen, 1 male, three females.

Holotype male, allotype female and paratopotypes deposited in the collection of the American Museum of Natural History, New York. Paratypes in the collection of the University of Idaho, Moscow. Paratopotypes and paratypes in the collection of Arizona State University, Tempe.

ETYMOLOGY: The species is named after

Martin A. Mortenson, Tempe, Arizona, to express my appreciation for his tremendous assistance in this and many other projects.

ECOLOGY: The types and paratopotypes were collected in the picnic and camping area of the Dixie-Snow Canyon State Park both in the fine red sand dunes and at an artificial wet spot under a leaky faucet in the parking area. The dunes were surrounded on three sides by red sandstone cliffs and black lava flows and were sparsely covered with *Artemisia tridentata* and scattered *Juniperus* and *Quercus* species in the higher areas and around the edges. On the dunes *mortensoni* was found running and flying from shady spot to shady spot beneath the *Artemisia* plants. In the parking lot they were attracted to the wet sand where they placed their spongy mouthparts on the wet surface and were evidently drinking. At 8 miles southwest of Cliff Dwellers Lodge the single male was found on a semiconsolidated dune running and making short flights over the sand between plants. At Cliff Dwellers Lodge a single female was found in association with *auripilosa* on damp soil at a leaky faucet beneath some shade trees.

VARIABILITY: Comparatively little variability was found in the 72 males and 34 females or in the terminalia of 28 male specimens that were dissected. The apical white transverse vitta on abdominal segment two was narrowly interrupted medially in 15 males, one male had the compound eyes separated from the lateral ocelli on the vertex by a little more than half the diameter of a lateral ocellus, nine males had both black and white macrochaetae on the second antennal segment, 23 males had from one to eight black macrochaetae irregularly arranged on the dorsal portion of the posterior head surface and in two males there were two and three white hairs on the base of the costal wing vein. In the females two were gray pruinose throughout, in four specimens the gray and tan pruinosity were mixed, the hairs at the base of the costal wing vein varied from being all black to black and white mixed to being all white.

RELATIONSHIPS: *Apiocera mortensoni* appears to be most closely related to *sylvestris*

but can be separated by its short subapical ventral lobes of the claspettes with the outer margins clothed from base to apex with long curved black hair. In *sylvestris* the subapical lobes are longer, the black curved hairs on the outer margin are strongly clustered toward the base and the remainder of the surface is golden pilose (fig. 52). Geographically *mortensoni* is close to *auripilosa*, *parahydra*, and *voragocolis*. From *parahydra* it is separable by its black rather than brown transverse broad vittae on abdominal segments three and four and by having the apex of the proctiger gradually descending rather than being bent sharply downward as in *parahydra* (fig. 74). *Apiocera voragocolis* (map 9) may occur near *mortensoni* (map 13) in horizontal distribution at 8 miles southwest of Cliff Dwellers Lodge but *voragocolis* would be about 700 feet below that location along the Colorado River sand bars. The two species are only distantly related and can be easily distinguished by the closed ventral dististyle margins (see fig. 14) and long black pile on the median projection of the ninth sternite in *mortensoni* (see fig. 14). In *voragocolis* the dististyles are open ventrally and there is no long black pile on the ventral surface (see fig. 13).

Apiocera mortensoni occurs geographically, ecologically, and chronologically together with *auripilosa* (map 11) at Cliff Dwellers Lodge but the two species are only distantly related, in spite of their superficial resemblance. *Apiocera mortensoni* has long black recumbent pile on the posterior projection of the ninth sternite (see fig. 14), the inner dististyle margins are apposed in the apical third (see fig. 14), the ventral subapical lobes of the claspettes are short and straight and the outer margins are evenly clothed with long curved black hair, the inner interbasal folds are biemarginate apically (see fig. 38) and the apex of the proctiger has two spinelike dorsal projections. In *auripilosa* there is no long black recumbent pile on the median projection of the ninth sternite, the inner dististyle margins are widely separated in the apical third (see fig. 13), the ventral subapical lobes on the claspettes are long and curved and without long curved black hair along the out-

er margin, the inner interbasal folds have a single deep apical emargination (see fig. 39), and there are no dorsal spinelike projections on the apex of the proctiger.

13. *Apiocera fallax*, new species

Figure 77; Map 9

DIAGNOSIS: Medium-sized, narrow; pteropleura bare or with few scattered hairs anterior to metathoracic spiracles; dististyles elongate attenuated to acutely rounded apices, closed ventrally in apical third from transverse incisions in inner margins to apex, without subapical flare of long hair (see figs. 14, 32, 45); posterior tarsal pulvilli broad, two-thirds as long as claws; abdominal dark markings on segments two through four in uninterrupted transverse bands; posterior tibial macrochaetae black; hemitergites with deep parallel-sided subapical notch in posterior margin (see fig. 33); proctiger not Y-shaped apically (see fig. 73); locking fold on inner hemitergite surface weakly convoluted, not extending ventrally to hemitergite margin (see fig. 33); ventral lobes of claspettes moderately long and straight, surface clothed with short golden pile, outer margin with long curved black hairs (see fig. 57); dorsolateral arms of proctiger produced posteriorly well beyond apex of subapical dorsal opening, lateral irregular shieldlike projections extending prominently outward and downward from base of dorsal subapical acute hornlike projections (fig. 77).

DESCRIPTION: Male: Head with front white pruinose, gradually yellowing toward vertex, white pilose below median ocellus, black pilose between and behind ocelli; antennal segments one and two white pruinose and pilose, segment one white macrochaetose, segment two black and white macrochaetose, segment three black, finely pruinose basally, coarsely pruinose apically, ending in short acute tooth; palpi pale yellowish, white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by almost the width of a lateral ocellus; posterior head margin white and tan pruinose, white pilose, white, brown and black macrochaetose. Thorax

with midpronotal area white pruinose and pilose, black macrochaetose, lateral angles gray pruinose black pilose and macrochaetose; mesonotum tan, gray, brown and black pruinose, markings black and brown pruinose, discal sparse short hairs brown or black, marginal and submarginal pile black, macrochaetae black; mesopleura gray pruinose, upper area sparsely black pilose lower area sparsely white pilose, dorsocaudal angle gray pruinose, bare except for few black hairs near bottom above junction with pleural suture; wings with entire costal margin black pilose; scutellum brown pruinose, black pilose, marginal macrochaetae black. Legs with coxae white pruinose and pilose, anterior and middle pair with macrochaetae white, posterior pair with macrochaetae black and white mixed; femora piceous, sparsely gray pruinose, brown and white pilose, black macrochaetose; tibiae reddish brown, anterior pair brown and white pilose, black macrochaetose, middle and posterior pair black pilose and macrochaetose; tarsi reddish brown, black pilose and macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with segment one broadly brown pruinose medially, narrow along basal margin, wide along apical margin, tan pruinose dorsolaterally along basal margin, dorsolateral small white pruinose spots not reaching margins, white pilose in basal third, brown and white pilose apically, lateral long hairs black and white mixed, subapical marginal macrochaetae black; segment two tricolored, basal third brown pruinose, bordered apically with black transverse vitta expanded laterally and medially, not reaching posterior margin, dorsolateral white pruinose areas between black expansions reaching posterior margin, posterior margin slightly darkened medially, black pilose throughout; segment three bicolored, light tannish pruinose basally along margin, expanded dorsolaterally to about basal third, appearing as a continuation of the apical white maculations on segment two, remainder of segment broadly black, black pilose throughout; segment four narrowly white pruinose dorsolaterally, interrupted medially by basal median extension of broad trans-

verse black vitta, apical margin narrowly white pruinose, black pilose throughout; segment five densely white pruinose, with fine median longitudinal dark line, small dorso-lateral brown pruinose spots near apical margin, black and white pilose; segment six densely white pruinose, black and white pilose; segment seven dark, black and white pilose; pleural areas of segments one through four broadly black, connected to dorsal black maculations and extending to pleural suture, primarily black pilose; sternites of segments one through four gray pruinose, white pilose, segments five through seven white pruinose, black and white pilose. Terminalia: Exterior. Unicolorous piceous, black pilose throughout; hemitergites with dorsal margin angulate at apical third, extending straight posteriorly to apex, apex extending slightly beyond posterior margin, posterior margin with deep, parallel-sided subapical notch, margin straight in upper portion, evenly rounded into ventral margin (see fig. 33); dististyles elongate, attenuated apically into acutely rounded apices, ventral margin with narrow postmedian incision (see fig. 32), closed ventrally from postmedian incision to apex (see fig. 14); median projection of ninth sternite flat, not overlapping dististyles laterally, clothed with long, black, recumbent hairs, extending posteriorly to postmedian incision in dististyle margins (see fig. 14). Terminalia: Interior. Hemitergites with sparse black pile along dorsal margin posterior to angulation, more dense medially on straight portion of margin, dense tuft of short erect black spinelike hair at median base of locking fold, locking fold sharply elevated above hemitergite surface, extending downward and anteriorly as a footlike projection, not reaching ventral hemitergite margin, deeply convoluted basally to surface attachment (see fig. 33); tuberculate area large, rounded, anterior to and below angulation in dorsal margin, not reaching dorsal margin or surface attachment of locking fold; proctiger narrow dorsally, lateral margins widest post-medially, gradually narrowed anteriorly to expansion into membranous area, sharply constricted posteriorly to junction with lateral apical arms and to dorsal median open-

ing, base of lateral arms with prominent hornlike pointed posterior projections, curved inward, lateral arms extending laterally outward and curved posteriorly from base of hornlike projections, dorsal posterior margin hooked inward and irregular, extending outward and downward, lateral descending margin deeply emarginate medially, expanded outward below emargination to ventral lateral points, forming a lateral shield with irregular margins, median ventral posterior apical projections extending slightly downward from base of lateral arms, almost directly below attachment of hornlike projections, then posteriorly beyond all other projections, bent sharply downward apically into acute points on each side of aedeagus (fig. 77); claspettes shallowly arched from near base to slightly enlarged, evenly rounded apices, inner margins from near base to near apices densely golden pilose (see fig. 53), subapical ventral lobes short and straight, surface clothed interiorly with golden pile, dorsal and outer margins clothed with long curved black pile, more dense at base (see fig. 53); interbasal fold deeply biemarginate apically in dorsal margin (see fig. 38), median separation golden pilose. Length 22.2 mm.; mesonotal width 5.4 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The front of the head is tan pruinose and brown pilose immediately below the median ocellus as well as on the vertex. Mesonotum primarily tan pruinose. The abdominal markings consist of large black dorsolateral median spots on segments two through four, spots somewhat transverse, especially on segment two, margins rounded. Length 19.0 mm.; mesonotal width 4.8 mm.

TYPE MATERIAL: Holotype male, allotype female, eight male and nine female paratopotypes collected 5 miles up Big Creek from where it enters Pine Flat Reservoir, T₁₁S, R₂₅E, S₁₅, elevation 1600 feet, Sierra National Forest, July 27, 1974 and August 12, 1972, Fresno County, California, James O'Grady. Two male and one female paratypes collected at T₉S, R₂₁E, S₁ (2 miles south Fine Gold), Madera County, California, August 20, 1972 by James O'Grady.

Holotype male, allotype female deposited in the California Academy of Sciences, San Francisco by James O'Grady. Paratopotypes and paratypes deposited in the collection of James O'Grady, Tucson, Arizona; the American Museum of Natural History, New York; and Arizona State University, Tempe.

ETYMOLOGY: From the Latin adjective *fallax*, meaning deceptive or fallacious, in reference to the masquerading of this species under *haruspex haruspex* with which it is indistinguishable except for the structure of the proctiger.

ECOLOGY: According to James O'Grady (personal commun.) both locations where the species has been collected are in an area of intermittent streams in a typical foothill woodland association of digger pine, *Pinus sabiniana* Douglas, buck-brush, *Ceanothus fendleri* Gray, and oak, *Quercus* species.

VARIABILITY: The series of 11 males and 11 females, of which all males were dissected, show little variability in any of the characteristics, including the abdominal maculations.

RELATIONSHIPS: *Apiocera fallax* (map 9) is evidently a sibling species of *haruspex haruspex* (map 4) with which it occurs together geographically, ecologically, and chronologically at the type locality. *Apiocera fallax* can be separated by the large ornate lateral arms of the proctiger (fig. 77) which are absent in *haruspex haruspex* (fig. 73). This single character will also separate *fallax* from all other known species of *Apiocera*.

14. *Apiocera acuticauda*, new species

Figure 44; Map 2

DIAGNOSIS: Medium-sized, narrow; pteropleura bare anterior to metathoracic spiracles; dististyles closed ventrally in apical third from transverse incisions in inner margins, attenuated posteriorly to acutely pointed apex (fig. 44); posterior tarsal pulvilli broad, almost as long as claws; dististyles densely black pilose apically and subapically, without subapical flare of hair; transverse black bands on abdominal segments three and four uninterrupted and extending across dorsum; posterior tibiae black macrochaetae.

tose; hemitergites with deep parallel-sided subapical notch in posterior margin; proctiger not Y-shaped apically; locking fold not extending ventrally to hemitergite margin; ventral lobes of claspettes long and straight, surface clothed with short golden pile, outer margin with long curved black hairs; dorso-lateral apical arms of proctiger produced well beyond apex of subapical dorsal opening, without irregular fanlike projections.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex between and behind ocelli brown pilose; antennal segments one and two white pruinose and pilose, segment one white macrochaetose, segment two black and white macrochaetose, segment three dark, gray pruinose basally, brown pruinose medially and apically, ending in short acute tooth; palpi yellowish, white pilose and macrochaetose, compound eyes separated from lateral ocelli on vertex by about the width of a lateral ocellus; posterior head margin white pruinose and pilose, macrochaetae white, brownish or black mixed. Thorax with middorsal pronotal area white pruinose and pilose, black and white macrochaetose, lateral angles gray pruinose, black pilose and macrochaetose; mesonotum tan pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile brown, macrochaetae black; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle gray pruinose, bare; scutellum gray and brown pruinose, black and white pilose, marginal macrochaetae black. Legs with coxae gray pruinose, white pilose, anterior and middle pair white macrochaetose, posterior pair mixed black and white macrochaetose; femora piceous to black, sparsely gray pruinose, black and white pilose, black macrochaetose; tibiae reddish brown, sparsely gray pruinose, brown and white pilose, black macrochaetose; tarsi reddish brown, anterior pair brown and white pilose, black macrochaetose, middle and posterior pair brown pilose, black macrochaetose; tarsal pulvilli broad, almost as long as claws. Abdomen with segment one golden brown pruinose medially from anterior to posterior margins, dorsolateral areas gray pruinose, white pilose basally

and medially, lateral dense long hairs primarily black, subapical marginal row of macrochaetae black; segment two with wide grayish tan transverse basal vitta, interrupted medially by golden brown longitudinal median vitta extending from median black transverse vitta to basal margin, black transverse vitta with posterior margin indented dorsolaterally by white pruinosity, black median margin extending into white pruinose apical transverse vitta, not reaching apical margin, pile brown dorsally, white laterally; segment three with wide white pruinose transverse vitta, narrowly interrupted medially by pale golden pruinose extension of wide median black transverse vitta to basal margin, apical margin narrowly white pruinose, median section wider white than lateral margin, pile brown dorsally, white laterally; segment four with dorsolateral white pruinose basal intrusions into wide black transverse vitta, narrowly separated medially, pile brown dorsally, white laterally; segments five and six tan pruinose, primarily white pilose; segment seven brown, brown pilose; pleural areas gray pruinose, white pilose, segment one with small rounded dark area near base above suture, segments two and three with lateral spots connected to dorsal dark vittae; sternites gray pruinose, white pilose. Terminalia: Exterior. Unicolorous piceous, black pilose throughout; hemitergites with dorsal margin feebly emarginate at apical third, margin straight in apical third, apex not produced posteriorly beyond posterior margin, posterior margin with deep parallel-sided subapical notch, invagination of margin at notch forming interior locking fold, margin below notch straight for short distance, shallowly emarginate ventrally, rounded to ventral margin, surface sparsely short black pilose; dististyles elongate, narrow, gradually attenuated posteriorly to acute apical point (fig. 44), closed ventrally from narrow shallow postmedian transverse incisions in inner margins to apex, inner margins narrowly overlapping each other from posterior to incision to beginning of sharp attenuation to apex, moderately densely black pilose along longitudinal elevation from incision to apex, sparsely black pilose

on remainder; median projection of ninth sternite flattened, not overlapping dististyles laterally, basal areas on each side of narrow median projection with short to medium length black hair, lateral margins and median areas of narrow projection clothed with long dense hairs projecting posteriorly to or slightly beyond incisions in inner dististyle margins. Terminalia: Interior. Hemitergites with sparse black pile along dorsal margin and submargin in apical third, extending downward to small dense cluster of erect black bristle-like hairs on midbase of locking fold, opposite widest portion of fold, locking fold formed by invagination of posterior margin, sharply elevated above hemitergite surface, extending horizontally to it and not projecting ventrally to hemitergite margin, deeply convoluted near subapical notch and near basal attachment to surface, surface bare and smooth, tuberculate area rounded anterior to emargination in dorsal margin in upper third of hemitergite, not reaching dorsal margin of locking fold; proctiger narrow dorsally, lateral margins subparallel, slightly wider medially, expanded basally into membranous area, forking apically at middorsal opening, lateral arms extending slightly outward, downward around aedeagus, lateral apical arms extending posteriorly from base at middorsal opening and slightly downward, descending portion shallow S-shaped, extending downward on each side of aedeagus, posterior extent of middorsal opening with sharply pointed slightly inturned projections on basal connection with posterior lateral arms; claspettes slightly angled upward from near base, apices evenly rounded, inner dorsal margins densely clothed from near base to near apex with long curved golden pile, subapical ventral lobes long and straight, wide basally, pointed apically, sparsely golden pilose, outer margin with long curved black hairs; interbasal fold biemarginate apically in dorsal margin, median separation golden pilose. Length 19.2 mm.; mesonotal width 4.2 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. Abdominal segments one through three mottled gray pruinose, segments two through four

with middorsolateral black spots, smaller on segment four, middorsal longitudinal irregularly and faintly brown pruinose areas on segments one through three, small dorsolateral white pruinose irregular spot near basal margin extending obliquely posteriorly to midline. Femora reddish brown, tibiae and tarsi light reddish brown. Length 18.6 mm.; mesonotal width 4.5 mm.

TYPE MATERIAL: Holotype male, allotype female, 18 male and seven female paratopotypes and one paratopotypic mating pair collected at the Mouth of Deep Creek, San Bernardino County, California, August 11, 1956 by E. I. Schlinger and J. C. Hall. One male paratype 3 miles south of Highland, San Bernardino County, California, August 5, 1957, John T. Doyen. Five male paratypes Palm Springs, Riverside County, California, July 21, 1952, J. W. MacSwain.

Holotype male, allotype female, paratopotypes and a paratype in the collection of the University of California, Davis. Paratypes in the collection of the University of California, Berkeley. Paratopotypes in the collection of the American Museum of Natural History, New York. Paratopotypes and paratypes in the collection of Arizona State University, Tempe.

ETYMOLOGY: From the Latin *acuta*, meaning sharp and *cauda*, meaning tail in reference to the attenuated and sharply pointed dististyles of the terminalia.

ECOLOGY: No information is available on either the drinking or breeding sites.

VARIABILITY: In the series of 37 specimens, of which 16 males were dissected, there is comparatively little variability except in the abdominal maculations. These vary from having slightly narrower or slightly wider white transverse pruinose vittae and in some specimens the white pruinosity on the apical margin of segment three is missing, whereas in others the entire apical margin of this segment is narrowly white pruinose. The color of the macrochaetae on the back of the head and the midpronotal areas vary in percentage of black to white and an occasional white macrochaeta can be found on the margin or submargin of the mesonotum. The terminalia characters are re-

markably stable within and between the three geographical areas.

RELATIONSHIPS: This species has been masquerading under *Apiocera haruspex haruspex* with which it bears a superficial resemblance. It can however be readily separated from that species by its attenuated and sharply pointed dististyles (fig. 44), by its lighter colored mesonotal pruinosity, by usually having more white abdominal pruinosity, by its narrower proctiger, by its less evident transverse incisions in the inner dististyle margins (fig. 44), and by having the compound eyes separated from the lateral ocelli on vertex by about the width of a lateral ocellus. In *haruspex haruspex* the compound eyes are separated from the lateral ocelli on the vertex by half or less than half the width of a lateral ocellus. At the present time the only other described species besides *acuticauda*, that has the dististyles attenuated and sharply pointed is, *foleyi* Cazier. However, in *foleyi* the dististyles are not as elongate as in *acuticauda* and the lateral apical proctigean arms are divergent and Y-shaped rather than subparallel and posterior as in *acuticauda*. In *acuticauda* there is a tuft of black spinelike hair at midbase of the hemitergite locking folds. In *foleyi* this area is bare.

Apiocera acuticauda (map 2) occurs geographically and probably ecologically and chronologically together with *notata* (map 12) at the Mouth of Deep Creek. Only five days, August 6 to August 11, 1956, separates their collecting dates at this locality. See discussion under *notata*. At Palm Springs Station, *acuticauda* occurs geographically, ecologically and chronologically, although not closely related, together with *wilcoxi* (map 1), *interrupta* (map 6), and *pearcei* (map 10). From *wilcoxi* it can be separated as discussed under that species. From *interrupta* it can be separated by lacking the dense erect patch of hairs on the inner surface of the locking fold, by having biemarginate apices on the inner interbasal folds (see fig. 38), by having the claspettes clothed with long curved black pile and by its transverse dark abdominal maculations. In *interrupta* there is a dense patch of short erect pile on the

inner surface of the locking folds (see fig. 34), the apex of the inner interbasal folds have a single deep emargination (see fig. 39), it lacks the long dark curved hair on the outer margin of the subapical lobes of claspettes and its dark abdominal maculations are longitudinal and dorsolateral. In *pearcei* there is no long recumbent pile on the posterior projection of the ninth abdominal sternite (see fig. 13), the inner dististyle margins are widely separated in the apical third (see fig. 13), there are no long dark curved hairs on the outer margin of the subapical ventral lobes of the claspettes and the inner interbasal folds have a single deep apical emargination (see fig. 39). There are many other differences separating these four sympatric species.

15. *Apiocera sylvestris*, new species

Figure 52; Map 1

DIAGNOSIS: Small-sized, narrow; pteropleura bare, gray pruinose in front of metathoracic spiracles; dististyles closed ventrally from moderately deep narrow transverse incision posteriorly to apex, without subapical flare of long hair; posterior tarsal pulvilli broad, more than half as long as claws; abdominal dark markings on segments two through four in transverse bands; hind tibial setae black; hemitergites with moderately deep, acute subapical notch; abdominal segments five and six with or without evident middorsal dark longitudinal line and dorsolateral dark spots; compound eyes separated from lateral ocelli on vertex by about the diameter of a lateral ocellus; costal wing vein black pilose; inner subapical lobes of claspettes with external row of long black curved hair directed ventrally, claspettes with upper edge in distal half moderately pilose internally (fig. 52); posterior margin of abdominal segment three narrowly to broadly white, tan or gray pruinose dorsally, rarely black.

DESCRIPTION: Male: Head with front white pruinose in ventral half, pale yellowish pruinose in dorsal half to vertex, white pilose below median ocellus, brown pilose between ocelli and on vertex; antennal segments one and two white pruinose and pilose, macrochaetae white except for one black one on

each of these two segments, segment three uniformly dark, finely bicolored pruinose, ending in short acute tooth; palpi white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about the width of a lateral ocellus; posterior head margin white pruinose, pilose and macrochaetose. Thorax with pronotal angles tan pruinose, black pilose and macrochaetose; mesonotum tan pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile brown and white mixed, macrochaetae black; mesopleura gray pruinose, sparsely white pilose; wings with costal margin black pilose except for few white hairs at base; scutellum gray pruinose, brown pilose, marginal macrochaetae black. Legs with coxae gray pruinose, white pilose and macrochaetose; femora piceous, gray pruinose, anterior pair white pilose and macrochaetose, middle pair white and brown pilose, black macrochaetose, posterior pair brown pilose, black macrochaetose; anterior and middle tibiae reddish brown, white pilose, black macrochaetose, posterior pair piceous, brown pilose, black macrochaetose; tarsi reddish brown, brown pilose, black macrochaetose; tarsal pulvilli moderately broad, two-thirds as long as claws. Abdomen with segment one brown pruinose in basal third, vitta expanded medially reaching posterior margin in middle third, gray pruinose dorsolateral areas reaching apical margin, white pilose throughout, subapical row of macrochaetae black, lateral apical pile primarily white but with few black hairs mixed; segments two and three brown pilose dorsally, white and brown pilose laterally, with middorsal transverse black vittae extending from dorsolateral areas, reaching basal margin medially, basal gray pruinose areas reaching basal margin, apical margin widely gray pruinose; segment four with wide black transverse vitta across dorsal surface reaching basal margin medially, gray pruinose basal areas extending into black vitta, apical margin (not including membrane) black; segments five through seven irregularly pruinose basally, reddish brown apically, sparsely white pilose, segment five with irregular fine longi-

tudinal middorsal line; dark dorsal markings on segments two through four not reaching pleural suture, pleural areas white and brown pilose; sternites reddish brown with scattered irregular gray pruinosity, pile white. Terminalia: Exterior. Bicolored, piceous dorsally and ventrally, ventral and apical area of hemitergites lighter reddish brown, black and brown pilose throughout, dorsal margin shallowly emarginate at about apical third, apex projecting beyond posterior margin as a finger-like process, entire margin rather densely clothed with short black pile, posterior margin with deep acute subapical notch. Dististyles evenly rounded apically, inner margin with narrow deep postmedian incision, closed ventrally from incision to near apex; median projection of ninth sternite flat, not overlapping dististyles laterally, surface obscured by long dense black hairs, lateral hairs extending to incision in dististyles, median hairs extending posteriorly well beyond incision. Terminalia: Interior. Hemitergites with posterior margin curved inward from venter of notch, looping downward and outward forming locking fold, ventral margin straight, evenly rounded apically to posterior margin, locking fold prominently protruding from hemitergite surface, extending ventrally and horizontally to surface, margin evenly rounded ventrally, extending dorsally to attachment with surface at about apical third and slightly below middle longitudinally, surface irregular and wavy, ventral margin not extending below hemitergite margin, vertical elongate narrow patch of erect bristle-like hairs extending from inner upper attachment of locking fold almost to dorsal margin, tuberculate area small round and situated close to dorsal margin and immediately anterior to emargination in dorsal margin; proctiger slightly constricted basally, expanded into membranous area, strongly constricted apically to median subapical triangular opening separating posterior lateral projections, triangular opening with posterior apex open, apical margins extending posteriorly into two small acute dorsal projections, basal margin of opening extending downward on each side ending in membranous ventral extension, posterior projections

of margins from opening and below dorsal projections shallowly S-shaped, bluntly terminated posteriorly, extending downward anterior to ends, downward extensions broadly expanded dorsally, acutely pointed ventrally and extending downward on each side of aedeagus; claspettes slightly curved from base to apex, enlarged and evenly bluntly rounded apically, upper margin moderately clothed with golden pile, subapical ventral lobes short straight thick, pointed apically, inner and apical portions sparsely clothed with short golden pile, outer basal margins clothed with long curved black hair (fig. 52); interbasal folds with dorsal apical margins biemarginate, median separation golden pilose. Length 18.5 mm.; mesonotal width 3.7 mm.

FEMALE: In addition to the secondary sexual characteristics the female has a number of distinctive features. The pruinosity is gray except for the brown pruinose mesonotal markings, the costal wing margins are primarily white pilose at base, the femora are reddish brown, the tibiae are white pilose, and abdominal segments two and three have dorsolateral dark subtriangular spots. Length 16.1 mm.; mesonotal width 4.1 mm.

TYPE MATERIAL: Holotype male, allotype female, 13 male and two female paratopotypes collected in Marijilda Canyon, Graham Mountains, Graham County, Arizona, 4000 feet, June 21, 1966 by J. M. Davidson and M. Cazier. Two male and two female paratypes collected 12 miles southwest of Kingman, Mohave County, Arizona, June 30, 1966 by R. L. Westcott. Four male, three female paratypes collected at Tucson, Pima County, Arizona, May 27 and 29, 1962 by F. D. Parker and L. A. Stange.

Holotype male, allotype female in the collection of the American Museum of Natural History, New York. Paratypes in the collection of the University of Idaho, Moscow. Paratopotypes in the collection of Arizona State University, Tempe. Paratypes in the collection of the University of California, Davis.

ETYMOLOGY: From the Latin *silvestris*, meaning woods or forest which characterizes the habitat at the type locality.

ECOLOGY: The types and paratopotypes were collected about 1 mile east of the lower camp ground at the mouth of Marijilda Canyon where the two dirt automobile tracks, mistakenly called a road, crossed through a patch of oak woodland. At this point Marijilda Creek had been channeled and some of the oaks had been cleared away. The flies were found primarily in the cleared area, under the oaks and on the damp ground bordering the ditch. In the latter habitat they appeared to be drinking.

VARIABILITY: Among the 17 specimens of the paratopotype series, of which seven males were dissected, and in the 11 paratypes, of which four males were dissected, there was little or no variability even in minor characteristics. Only two of the males, including the holotype, had one or two black macrochaetae on the second antennal segment. Only one male had reddish brown tibiae, whereas in the remainder of the series both femora and posterior tibiae were piceous to black in color. In the abdominal markings the variability was confined to slight increases in the width of the dark transverse vittae.

RELATIONSHIPS: *Apiocera sylvestris* appears to belong in the *haruspex* complex, based on the long black pile on the median projection of the ninth sternite (fig. 14), but can be separated by having the apical margin of abdominal segment three entirely or in part gray dorsally instead of black as in *haruspex haruspex*. Also, the golden pile on the claspettes is less dense in *silvestris* (fig. 52) and the dorsal macrochaetae on the posterior head surface are white rather than black. From *mortensoni* it can be separated by having the compound eyes separated from the lateral ocelli on the vertex by about the width of a lateral ocellus, instead of by about half or less than half the width as in *mortensoni*. In *silvestris* the proctiger has two spinelike vertical projections on the posterior margins of the median opening and S-shaped posterior projections arising from beneath the vertical projections. In *mortensoni* the vertical projections are blunt and the posterior projections are not S-shaped and project downward at about a 45-degree angle

from beneath the vertical projections. *Apiocera sylvestris* (map 1) appears to be allopatric with *haruspex haruspex* (map 4) and *mortensoni* (map 13), but may eventually be found sympatrically with *painteri* (map 13) in the Tucson area. *Apiocera painteri* can be readily separated from *sylvestris* by lacking long recumbent pile on the median posterior projection of the ninth abdominal sternite (see fig. 13), and by having no postmedian incisions in the inner dististyle margins which are not apposed from the apex of the median projection of the ninth sternite to near the apex (see fig. 13).

16. *Apiocera haruspex haruspex*
Osten Sacken

Figures 14, 32–33, 38, 45, 53, 57, 73; Map 4

Apiocera haruspex Osten Sacken, 1877, pp. 283–284.

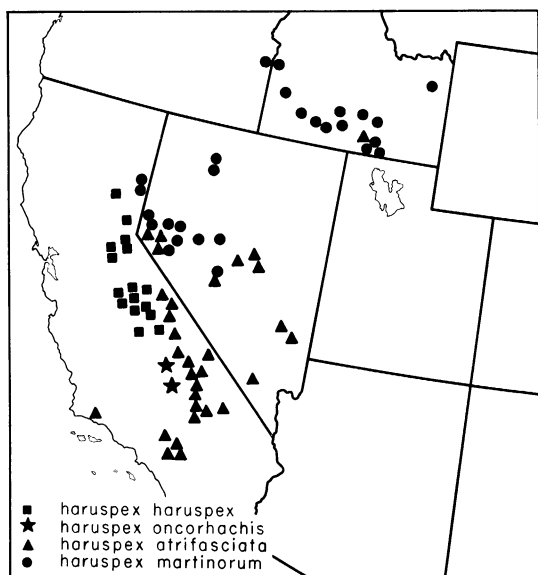
DIAGNOSIS: Male: Medium-sized, moderately wide; pteropleura bare or sparsely pilose anterior to metathoracic spiracles; dorsocaudal angle of mesopleura without macrochaetae on discal area; posterior tibial macrochaetae black; abdominal segment two brown pilose dorsally, dark markings on segments three and four black or brown, usually not infuscated, apical margin of third segment entirely or partially black; posterior head surface with dorsal macrochaetae usually entirely black or predominantly black; median posterior projection of ninth abdominal sternite with long dense recumbent black pile extending posteriorly from basal and lateral margins and dorsum to or a little beyond the transverse postmedian incisions in the inner dististyle margins (fig. 14); inner dististyle margins apposed (closed) from transverse incisions to near apex (fig. 14). Terminalia: Interior. Claspette with ventral subapical lobes medium in length, straight (fig. 53), ventral claspette margins with short golden median hairs arranged fanlike, not extending beneath proctiger or aedeagus (fig. 57), ventral subapical lobes with long curved usually black hair along outer margin (figs. 53, 57), upper inner claspette margins moderately to densely golden pilose (fig. 53); inner interbasal folds deeply biemarginate dor-

soapically and subapically (fig. 38); inner surface of hemitergite locking folds bare or with few scattered hairs (fig. 33), midbasal area next to hemitergite surface with tuft of short erect black hairs (fig. 33), proctiger with prominent posterior dorsal extensions beyond apices of middorsal apical opening (fig. 73), apices with dorsal projections usually acute (fig. 73), posterior extensions arising from beneath dorsal spines (fig. 73), dorsal opening wide, rounded or broadly transverse, without wide shieldlike extensions arising from basal area of dorsal opening (fig. 73); dististyles abruptly or not attenuated, terminating in a rounded or blunt point (figs. 32, 45).

FEMALE: Abdominal dorsolateral dark maculations in spots; posterior tarsal pulvilli moderately wide, more than half as long as claws; pteropleura usually bare or with a few hairs anterior to metathoracic spiracles; outer posterior surface of posterior tibiae brown or black pilose; outer surface of posterior femora brown or black pilose; anterior femora with inner concave surface primarily brown or black pilose; abdominal segment four with discal pile brown or black.

TYPE LOCALITY: Yosemite Valley, Mariposa County, California. Holotype male in the British Museum of Natural History, London, England.

DISTRIBUTION: California: Mariposa County: Yosemite Valley, September 11, 1963, no collector. Tuolumne County: Strawberry, August 2–20, 1960, C. A. Toschi, E. Jessen, J. W. MacSwain, G. W. Collier, D. Q. Cauagnaro, A. S. Menke, M. E. Irwin, R. R. Montanucci, T. Gantenbein; Usona, August 5, 1938, T. Aitken, M. Cazier; Longbarn, August 8, 1960, A. S. Menke, M. E. Irwin; Yosemite National Park, 5 airline miles north El Portal, A. Raske; Sonora Pass, 2 miles northeast, August 14, 1960, R. W. Thorp; Browns Meadow, August 12–13, 1960, A. S. Menke, G. W. Collier; Pinecrest, August 9, 1948, P. H. Arnaud, Jr.; Camp Mather, July 12, 1954, O. Rentz. El Dorado County: Al Tahoe, August 8, 1960, J. A. Goodwin; Pollock Pines, August 19, 1953, E. I. Schlinger, A. A. Grigarick; 4 miles southeast Somerset, September



MAP 4. Distributions of *Apiocera* sp.: *A. haruspex haruspex*, *haruspex oncorhachis*, *haruspex atrifasciata*, *haruspex martinorum*.

16, 1967, 2000 feet elevation, V. Lee; 2 miles southwest Somerset, August 3, 1978, B. Wharton; 3 miles southwest Somerset, August 14, 1978, B. Wharton. Mono County: Sherwin Summit (old 395), September 1, 1965, P. Rude. Nevada County: Donner Pass, July 31, 1959, J. R. Helfer. Plumas County: Halsted Campground, East Branch North Fork, Feather River, August 15, 1977, 840 meters, P. H. Arnaud, Jr. Fresno County: Millwood, August 23, 1952, J. C. Hall; 5 miles up Big Creek from where it enters Pine Flat Reservoir, T₁₁S, R₂₅E, S₁₅, elevation 1600 feet, Sierra National Forest, July 27, 1974, and August 12, 1972, James O'Grady.

ECOLOGY: In the area of Somerset, Bob Wharton found that "most of the *Apiocera* are within rock throwing distance of the middle fork of the Cosumnes River, though I do collect them on sandy hillsides at least a mile away from the river" (personal commun.). At the Big Creek location James O'Grady (personal commun.) characterizes the area

as one of intermittent streams in a typical foothill woodland association of digger pine, *Pinus sabiniana*, buck-brush, *Ceanothus fendleri* and oak, *Quercus* species.

RELATIONSHIPS: *Apiocera haruspex haruspex* has always been rather confusing primarily because of its great variability in certain characteristics, its extensive distribution and rather stereotyped abdominal maculation pattern. In the present study in which long series of specimens in this complex were available and in which the interior structures of the male terminalia were used, it is quite apparent that what has been referred to previously as *haruspex* is actually a complex of species and subspecies. What has in the past been masquerading as *haruspex* is herein being divided into *wilcoxi* (map 1), *foleyi* (map 1), *chrysolasia* (map 1), *acuticauda* (map 2), *ogradyi* (map 1) in southern California; *barri* (map 2), middle and northern California, Oregon, Washington, and British Columbia; *fallax* (map 9) a sibling species from Fresno County; the remainder represent four subspecies, *haruspex haruspex* (map 4) from the Sierra Nevada Mountains, *haruspex oncorhachis*, new subspecies (map 4), from Tulare County, *haruspex atrifasciata*, new subspecies (map 4), from California east of the Sierra Nevada Mountains and from Nevada and southern Idaho, and *haruspex martinorum* (map 4) from northern California, Nevada, and southern Idaho. The northern Idaho specimens of *haruspex martinorum* were found to be *barri*. These species and subspecies can be separated as given in the key and in the relationship sections of each.

Apiocera haruspex haruspex occurs geographically, ecologically, and chronologically together with *fallax* and can be separated from it as given in the discussion of the latter species. *Apiocera haruspex haruspex* can be separated from its allopatric subspecies *haruspex oncorhachis* as given in the discussion of the latter subspecies. The differences and relationships between *haruspex haruspex* and *haruspex martinorum* can be found under the discussion of *haruspex atrifasciata*.

17. *Apiocera haruspex oncorhachis*,
new subspecies
Map 4

DIAGNOSIS: Medium-sized, narrow; pteropleura bare or with moderately dense long white hair anterior to the metathoracic spiracles; dorsocaudal angle of mesopleura bare, tan pruinose; posterior tibial macrochaetae black; dististyles closed ventrally in apical third from postmedian transverse incisions in inner margins to apex of dististyles (see fig. 14); compound eyes separated from lateral ocelli on vertex by almost the width of a lateral ocellus; transverse dark bands on abdominal segments three and four not interrupted dorsolaterally; locking fold of inner hemitergite surface with large group of long erect stiff black hair, contiguous with thin submarginal black dorsal hairs; proctiger with dorsal posterior projections long, sharply hooked posteriorly in apical third, dorsoapical opening wide and transverse; posterior head surface white macrochaetose.

DESCRIPTION: Male: Similar to those of *haruspex haruspex* in most characteristics but usually separated by the entirely or predominantly white macrochaetae on the dorsal portion of the posterior head surface, by its long hooked dorsal proctigeal posterior projections, its larger tuft of long erect stiff black hair at the midbase of the locking fold, usually contiguous with dorsal submarginal hairs and by its disjunct distribution (map 4). In *haruspex haruspex* the dorsal portion of the posterior head surface is entirely or usually predominantly black macrochaetose, the posterior dorsal proctigeal projections are short and not hooked apically (fig. 73), the tuft of stiff erect black hair at the base of the locking fold is smaller and usually isolated from the submarginal dorsal hairs (fig. 33). *Apiocera haruspex haruspex* (map 4) occurs in the higher elevations of the Sierra Nevada Mountains of California from Fresno County north to Plumas County. *A. haruspex oncorhachis* (map 4) is known only from two locations in southern Tulare County. Length 20.8 mm.; mesonotal width 4.8 mm.

FEMALE: Similar to those of *haruspex ha-*

ruspex except that the macrochaetae on the dorsal portion of the posterior head surface are predominantly white rather than black. In the allotype female there are six black macrochaetae in this area as compared with about 30 white. In *haruspex haruspex* the ratio is reversed in favor of black, or more often, all are black. Length 21.2 mm.; mesonotal width 6.1 mm.

TYPE MATERIAL: Holotype male, allotype female, one male paratopotype collected at Fairview, Tulare County, California, September 4, 1965 by P. Rude and J. Powell. Two male paratypes collected at Poison Meadow, Tulare County, Sequoia National Forest, August 4, 1959 by Ed Ball.

Holotype male, allotype female deposited in the collection of the California Academy of Sciences, San Francisco on an indefinite loan from the Essig Museum of Entomology, University of California, Berkeley. Paratopotypes and paratypes deposited in the collections of the Florida State Collection of Arthropods, State Plant Board, Gainesville; and Arizona State University, Tempe.

ETYMOLOGY: From the Greek *onco*, meaning hooked and *rhachis*, meaning spine in reference to the dorsal proctigeal projections which are hooked posteriorly in the apical third.

ECOLOGY: No information is available on either the drinking or breeding habitats of this subspecies.

VARIABILITY: In general appearance there is little variability in the four male specimens, all of which had the terminalia opened for study. In the two paratypes the size is smaller and narrower than in the type and paratopotype by about 2 mm. in length and 1 mm. in width. In the holotype there are two black macrochaetae on the posterior head surface, in the paratopotype only one, and in the paratypes they are all white or with a few brownish ones. The terminalia structures are the same.

RELATIONSHIPS: *Apiocera haruspex oncorhachis* can be separated from *haruspex haruspex* by its predominantly white macrochaetae on the posterior head surface, a character which is somewhat variable in both

populations. In *haruspex oncorhachis* the dorsal posterior lateral proctigeal arms are long and strongly angulate (hooked) posteriorly in the apical third, whereas in *haruspex haruspex* they are short, usually vertical or turned inward and in one of 43 specimens the tips were slightly bent posteriorly. From *haruspex atrifasciata*, which occurs in Owens Valley east of the Sierra Nevada Mountains, it can usually be separated by the hooked proctigeal process and by its more densely pilose inner claspette margins. In six specimens of *haruspex atrifasciata* from Big Pine, Inyo County, California the proctigeal process is either short and straight, slightly bent or strongly hooked posteriorly. In all other specimens of this subspecies, from many locations, they are short and straight. From *fallax*, which occurs in Fresno and Madera Counties north of Tulare County, *haruspex oncorhachis* can be readily separated by its lack of the prominent lateral fanlike projections on the proctiger, a unique feature of *fallax* (fig. 77).

18. *Apiocera haruspex martinorum* Painter
Figures 5, 101; Map 4

Apiocera martinorum Painter, 1936, pp. 197–198.

DIAGNOSIS: Male: Medium-sized, moderately wide; pteropleura with sparse long white discal hairs anterior to metathoracic spiracles; dorsocaudal angle of mesopleura bare; posterior tibial macrochaetae black; median posterior projection of ninth abdominal sternite with long dense recumbent black pile extending posteriorly from basal and lateral margins and dorsal area to narrow postmedian transverse incisions in inner dististyle margins (see fig. 14); dististyles not gradually attenuated apically, not sharply pointed (see fig. 45), inner margins apposed from postmedian incisions to near apex (see fig. 14); abdominal segment two primarily white pilose dorsally, dark markings on segments two through four narrowly or broadly interrupted dorsolaterally by longitudinal white or gray pruinose vittae (fig. 101), rarely not interrupted, segments five and six with prominent middorsal longitudinal dark line,

apical margin of segment three usually entirely or partially black, dorsal posterior head surface white macrochaetose, rarely with one or two black or brownish macrochaetae. Terminalia: Interior. Inner surface of hemitergite locking fold bare, small tuft short erect black hair on hemitergite surface at midbase of locking fold (see fig. 33), locking fold not extending to or beyond ventral or posterior hemitergite margins (see fig. 33); proctiger not Y-shaped apically, with prominent posterior dorsal extensions beyond apices of middorsal apical opening (see fig. 73), posterior extensions arising from beneath dorsal spines, sharply biangulate downward and posteriorly, dorsal opening wide, rounded, or broadly transverse (see fig. 73), without wide lateral shieldlike extensions arising from basal area of dorsal opening, dorsal basal projections of posterior lateral proctigeal arms short and straight or occasionally slightly angulate posteriorly at tips; inner interbasal folds deeply biemarginate dorsoapically and subapically (see fig. 38); claspettes with ventral subapical lobes medium in length, straight, with long curved black hair along outer margin, upper inner claspette margins densely clothed with golden pile (see fig. 53), ventral margin with median golden hairs short, arranged fanlike not extending beneath proctiger and aedeagus (see fig. 57).

FEMALE: Abdominal dorsolateral dark maculations on segments two through four in rounded dorsolateral spots; posterior tarsal pulvilli moderately wide, more than half as long as claws; pteropleura usually bare or with few scattered hairs; outer posterior surface of posterior tibiae entirely white pilose, femora piceous, tibiae reddish testaceous; discal pile on abdominal segments two and three white; costal wing vein white pilose basally; posterior tarsi with outer surface of segments one and two primarily white pilose.

TYPE LOCALITY: Adrian, Malheur County, Oregon, July 22, 1932, Dorothy Martin. Holotype male, allotype female in the C. H. Martin collection, in the California Academy of Sciences, San Francisco.

DISTRIBUTION: Oregon: Malheur County: Adrian, July 22–31, August 4, 11, 1934, D.



FIG. 5. Habitat *Apiocera haruspex martinorum*. Bruneau Dunes, Owyhee County, Idaho.

Martin. Idaho: Canyon County: Roswell Bench, Parma, August 4, 5, 1934, C. H. and D. Martin; 2 miles south Roswell, August 17, 1969, J. Bigelow, M. Mortenson, M. Cazier. Fremont County: 2½ miles northwest Plano, August 8, 1969, M. Mortenson, J. Bigelow, M. Cazier. Owyhee County: Dune Lake, August 9, 1966, W. F. Barr; 13 miles southeast Murphy, August 3, 1958, W. F. Barr; 8 miles north Grandview, August 1, 1959, W. F. Barr; Bruneau, August 7, 1969, J. Bigelow, M. Mortenson, M. Cazier; Bruneau Dunes, August 6, 1969, J. Bigelow, M. Mortenson, M. Cazier. Lincoln County: 7 miles west Shoshone, July 21, 1961, A. R. Gittins, R. B. Hawkes; Dietrich Butte, August 3, 1955, J. E. Gillaspay. Twin Falls County: 8 miles south Hagerman, August 12, 1969, J. Bigelow, M. Mortenson, M. Cazier. Gooding County: 5 miles west Hagerman, August 29, 1959, R. B. Hawkes. Cassia County: 7 miles southeast Malta, July 27, 1959, W. F. Barr; Malta, July 24, 1958 and July 24, 1961, W. F. Barr; 6 miles northeast Malta, July 30, 1964, R. L. Westcott; 5 miles northeast Malta, August 14, 1955, R. A. Mackie. The specimens from the Malta area appear to represent intergrades between *haruspex martin-*

orum and *haruspex atrifasciata*. Nevada: Humboldt County: Winnemucca, August 4, 9, 1958, T. R. Haig; Orvada, August 16, 1962, L. A. Stange. Churchill County: 21 miles south Fallon, July 31, 1972, G. M. Nishida; Fallon, August 14, 1970, J. R. Adams; Eastgate, September 9, 1972, G. M. Nishida; Sand Mountain, August 30, 1969, J. Bigelow, M. Mortenson, M. Cazier; 10 miles west Fallon, August 20, 1969, J. Bigelow, M. Mortenson, M. Cazier. Washoe County: Reno, August 4, 1960, F. D. Parker. California: Lassen County: 4 miles north Doyle, August 22, 1953, J. Lattin; Hallelujah Junction, August 5, 1966, J. Wilcox.

ECOLOGY: The type was taken on the Dwyler River sand dunes according to Painter (1938, p. 198). In the large unconsolidated dune area north of Plano a long series was taken at the edge of a cultivated field near the base of the dunes. They were in a large sandy field which was sparsely covered with sage-brush, *Artemisia* species, and in an irrigation water overflow area beneath and around willows, *Salix* species. Many were found along a dirt road traversing the area and under an unidentified species of tree beneath which there was an accumulation of

aphid honeydew on the ground and dead leaves. The flies were putting their fleshy mouthparts on the honeydew, just as they did on the damp sand in the willow area, and were presumed to be feeding and drinking. In the Bruneau Dunes State Park, a recreational area, the two large unconsolidated gray colored sand dunes cover about 600 acres and adjacent to them are several lakes covering more than 140 acres. The flies were abundant on the dunes, around the edges of the lakes, on a moist dirt road bordering the lake and under trees in the parking area (fig. 5). Many newly emerged specimens were found on the dunes, especially in depressions, and numerous pupal cases were protruding from the sand or being blown along the surface. Near Hagerman they were resting in the shade of sage-brush, *Artemisia* species, or running and flying over the sand between plants. At Sand Mountain a few specimens were found at the base of a white unconsolidated dune.

RELATIONSHIPS: *Apiocera haruspex martinorum* (map 4) intergrades with *haruspex atrifasciata* (map 4) in southern Idaho and northwestern Nevada and will probably be found to do so in northern and western Utah when specimens are available. See *haruspex atrifasciata* for the locations of intergradation and relationships.

19. *Apiocera haruspex atrifasciata*,
new subspecies
Figure 102; Map 4

DIAGNOSIS: Medium-sized, narrow; pteropleura bare or with a few scattered white hairs anterior to metathoracic spiracles; dorsocaudal angle of mesopleura bare dorsally; dististyles closed ventrally in apical third from transverse incisions in inner margins to apex; posterior tibial macrochaetae black; posterior tarsal pulvilli broad, more than half as long as claws; dististyles moderately wide, without ventral subapical flare of long hair; abdominal dark markings on segments two through four in uninterrupted transverse vittae (fig. 102); hemitergites with deep subapical notch in posterior margin; proctiger not Y-shaped, dorsolateral apical arms ex-

tending posteriorly well beyond subapical rounded transverse dorsal opening, without fanlike subapical lateral projections; apical margin of third abdominal segment entirely or partially black (fig. 102); upper inner margin of claspette moderately densely golden pilose, ventral lobes moderately long, wide at base, tapering to apical point, surface golden pilose, outer margin with long curved black hairs; locking fold on inner hemitergite surface not extending to ventral hemitergite margin; posterior head surface with dorsal macrochaetae usually entirely white or predominantly white or brownish; dorsal basal projections of posterior lateral proctigeal arms straight or occasionally angulate posteriorly at tips.

DESCRIPTION: Male: Similar to those of *haruspex haruspex* in most characteristics but usually separable by its entirely or predominantly white macrochaetae on the dorsal portion of the posterior head surface, by its less densely golden pilose dorsal inner claspette margins, by its usually larger tuft of long erect stiff black hair at the midbase of the locking fold, usually contiguous with dorsal submarginal hairs and by its disjunct distribution (map 4). In *haruspex haruspex* the dorsal portion of the posterior head surface is entirely or predominantly black macrochaetose, the golden pile on the dorsal inner claspette margins is very dense matlike (fig. 53) and the tuft of hair at the midbase of the locking fold is smaller and usually isolated from the dorsal submarginal hairs (fig. 33). *Apiocera haruspex haruspex* occurs in the higher elevations of the Sierra Nevada Mountains of California from Fresno County north to Plumas County (map 4). *Apiocera haruspex atrifasciata* occurs from western San Bernardino, Los Angeles and Santa Barbara Counties northeast in the valleys along the eastern side of the Sierra Nevada Mountains into central and southern Nevada (map 4). In some of the west central Nevada populations there are intermediates between this subspecies and the more northern *haruspex martinorum*. Length 21.1 mm.; mesonotal width 4.4 mm.

FEMALE: Similar to those of *haruspex haruspex* except that the macrochaetae on the

dorsal portion of the posterior head surface are predominantly white instead of black and the pile on the costal margin of the wing base has some white hairs instead of being all black. Length 16.3 mm.; mesonotal width 4.9 mm.

TYPE MATERIAL: Holotype male, allotype female collected at Manzanar, Inyo County, California, August 8, 1953 by F. B. Foley (in Joe Wilcox collection). Paratopotypes: Same data as holotype, 37 males, three females.

PARATYPES: California: Mono County: Mono Lake, August 25, 1969, September 13, 1963, Joe Wilcox, August 31, 1965, P. Rude, two males, two females; 5 miles southeast Tom's Place, August 25, 1969, Joe Wilcox, one male, three females; Grant Lake, July 28, 1959, August 5, 1948, J. W. MacSwain, R. W. Thorp, P. D. Hurd, eight males, 11 females; Mammoth, August 7, 1936 and 1956, August 9, 1957, August 22, 1963, August 6, 1966, Joe Wilcox, R. M. and G. E. Bohart, two males, seven females; 3 miles south Leevining, July 19, 1968, P. A. Opler, one female; 10 miles north Leevining, August 6, 1961, D. D. MacNeill, D. C. Rentz, M. R. Lundgren, one female; Bridgeport, August 13, 1952, August 11, 1959, R. C. Bechtel, D. C. Rentz, two males, five females; Travertine Hot Springs, 2 miles southeast Bridgeport, August 11, 1962, 6700 feet, H. B. Leech, one female; Hot Creek, August 29, 1969, R. M. Bohart, one female; Owens Valley, August 3, 1936, no collector, one male. Inyo County: Big Pine Creek, August 21, 1969, 7500 feet, Joe Wilcox, two females; Big Pine, July 10, 1953, August 5, 1957, August 24, 1960, August 7, 1966, August 22, 1963, C. H. Martin, Joe Wilcox, D. Q. Cavagnaro, D. D. Linsdale, eight males, three females; Independence, August 13, 1957, Joe Wilcox, one female; Lone Pine Creek, August 31, 1969, 4000 feet, R. M. Bohart, E. E. Grissell, five males; Owens Valley, August 2, 1937, no collector, one female; Antelope Springs, August 11, 24, 1960, H. K. Court and E. J. Jessen, two males; 16 miles west Bishop, September 8, 1964, M. R. Gardner, one female; Baxter, July 4, 1965, J. D. Berchim, one female; 12 miles northeast Panamint Springs, elevation 6400 feet, July 22,

1978, James O'Grady, five males. Santa Barbara County: Goleta, July 7, 1959, J. R. Russell, one male. San Bernardino County: Seven Oaks, August 30, 1965, July 14, 1971, Joe Wilcox, one male, one female; Hanna Flats, Big Bear Lake, August 15, 1951, Guy F. Toland, one female; South Fork Camp, 6000 feet, July 4, 1943, July 13, 1947, Joe Wilcox, two males; South Fork, San Bernardino Mountains, August 2, 1949, July 8, 1964, C. H. Martin, Joe Wilcox, three males. Los Angeles County: Big Pines, July 26, 1965, Joe Wilcox, one male, one female. County unknown: Glen Martin, August 16, 1920, F. R. Cole, three males, four females. Nevada: Lincoln County: Hiko, July 27, 1976, R. C. Bechtel, one female; Delamar, July 23, 1964, R. C. Bechtel, one female. Nye County: Yomba, August 17, 1961, F. D. Parker, one female; Dianas Punch Bowl, August 4, 1977, R. C. Bechtel, J. B. Knight, one female. Mineral County: Shurz, August 18, 1961, F. D. Parker, one female; Whiskey Flat, August 5, 1977, R. C. Bechtel, J. B. Knight, 13 males, eight females. Ormsby County: Carson City, August 7, 1972, G. M. Nishida, one female. Lyon County: Smith, July 3, 1960, F. D. Parker, one female; 4 miles north Yerington, August 27, 1967, R. L. Penrose, one male. Clark County: Kyle Canyon Campground, Charleston Mountains, 7100 feet, July 13, 1966, P. H. Arnaud, Jr., one female.

RECORDS: Nevada: Nye County: 7 miles northwest Round Mountain, August 16, 1961, F. D. Parker, one male without terminalia.

Intermediates between *haruspex martinatorum* and *haruspex atrifasciata*: Nevada: Mineral County: 6 miles south Mina, August 17, 1961, F. D. Parker, one male. Douglas County: 14 miles southeast Wellington, August 17, 1960, E. Jessen, D. Q. Cavagnaro, J. M. MacSwain, M. E. Irwin, R. R. Montanucci, A. S. Menke, six males, eight females.

Holotype male, allotype female deposited in the California Academy of Sciences, San Francisco by Joe Wilcox. Paratopotypes in the collections of Joe Wilcox, Anaheim, California; the American Museum of Natural History, New York; Arizona State Univer-

sity, Tempe. Paratypes are deposited in the collections of the University of California, Berkeley and Davis; the California Academy of Sciences, San Francisco; the University of Idaho, Moscow; Nevada State Department of Agriculture, Reno; the American Museum of Natural History, New York; Arizona State University, Tempe.

ETYMOLOGY: From the Latin *atrifas*, meaning black and *fasciata*, meaning banded in reference to the partially or entirely black apical margin on abdominal segment three.

ECOLOGY: According to James O'Grady the Panamint Springs specimens were taken at an elevation of 6400 feet in the Pinyon Pine-Juniper woodland where spring water was readily available.

VARIABILITY: In a few specimens there are from one to six black macrochaetae on the dorsal portion of the posterior head surface, in one specimen they are primarily brown, and the tuft of erect short black hair at the midbase of the locking fold may be small and isolated from the dorsal submarginal hairs or more often large and connected to them. In four of the 28 paratopotypic males the transverse black vitta on abdominal segment two is narrowly divided dorso-laterally by gray pruinosity. In one of the four specimens this division extends to segment three and the base of segment four. In the series of six males from Big Pine the shape of the dorsal posterior lateral proctigeal arms varies from being short and straight, to short and slightly hooked at the tip, to being long and moderately hooked in about the apical third. The latter variation resembles that found in *haruspex oncorhachis*. The male terminalia studies were made on 45 dissected specimens.

RELATIONSHIPS: *Apiocera haruspex atrifasciata* is one of four geographical subspecies into which the *haruspex* complex is divided. From *haruspex haruspex* it can usually be distinguished as given under males and females in the above description. It can usually be separated from *haruspex oncorhachis* as given under relationships in that subspecies and by its disjunct distribution (map 4). From *haruspex martinorum*, with which it intergrades in the area of Wel-

lington and Mina, Nevada, *haruspex atrifasciata* can be separated by its uninterrupted black transverse vittae on abdominal segments two through four and by having the posterior ventral proctiger arms thick, extending horizontally and posteriorly a short distance beyond the dorsoapical opening, bent sharply downward at about a 90-degree angle in apical half. In *haruspex martinorum* the posterior ventral proctiger arms are usually narrow, extending posteriorly and downward at about a 45-degree angle, ending in an acute point far beyond the dorsoapical opening. There are, however, occasional intermediates between the two subspecies especially as noted above and also under variability.

Apiocera haruspex atrifasciata (map 4) is sympatric with *macswaini* Cazier (map 11) at Antelope Springs but was collected in August 1960, whereas *macswaini* was taken in July 1953, and the two are only distantly related. In *haruspex atrifasciata* the inner dististyle margins are apposed in the apical third (see fig. 14), it has long black recumbent pile on the median projection of the ninth abdominal sternite (see fig. 14), the proctiger has dorsoapical spinelike projections (see fig. 73), and the ventral subapical lobes on the claspettes have the outer margins clothed with long curved black hair (figs. 53, 57). In *macswaini* the inner dististyle margins are widely separated (see fig. 13), it has no long recumbent hairs on the median projection of ninth abdominal sternite (see fig. 13), the inner interbasal folds have a single deep emargination apically (see fig. 39), the proctiger has no dorsoapical spinelike projections and the ventral subapical lobes on the claspettes have no long curved hairs on the outer margin.

20. *Apiocera bilineata* Painter

Figure 70; Map 5

Apiocera bilineata Painter, 1932, pp. 351–352.

DIAGNOSIS: Male: Small-sized, narrow; pteropleura bare; dististyles primarily white pilose, narrowly open ventrally in apical third from postmedian narrow transverse incisions in inner margins to near apex; median posterior projection of ninth sternite with

sparse long recumbent pile extending posteriorly from basal margin; posterior tarsal pulvilli small, less than half the length of the claws (fig. 70); femora piceous, at least in part, tibiae and tarsi testaceous; black lateral abdominal markings evident and similar on segments two through five, reduced on segment six, usually absent on segment seven. Terminalia: Interior. Inner interbasal folds with single deep dorsoapical emargination (see fig. 39); inner surface of hemitergite locking folds densely clothed with short erect dark hairs over half or more than half of surface (see fig. 34); claspettes with ventral subapical lobes medium in length, slightly curved downward.

TYPE LOCATION: White Sands, Otero County, New Mexico, R. H. Painter, E. M. Painter, H. M. Smith. Holotype male, allotype female in the National Museum of Natural History, Washington, D.C.

DISTRIBUTION: New Mexico: Otero County: White Sands, August 22, 1962, H. V. Weems, June 30, 1932, R. H. Beamer and July 23, 1933, W. Benedict. Mexico: Chihuahua: Samalayuca, June 24, 1947, M. Cazier and August 6, 1950, Ray F. Smith; 29 km. north Samalayuca, August 1, 1974, 1200 m., E. M. and J. L. Fisher; Villa Ahumada, June 28, 1947, M. Cazier.

ECOLOGY: According to Painter (1932, p. 352) the specimens at the type locality were found running about actively on the bare sand. At Samalayuca they were taken among short vegetation near the base of the Samalayuca dune field and about 100 m. from the nearest dwelling on highway 45. At Villa Ahumada they were found on a moist ditch bank where they were putting their mouthparts on the moist sandy soil.

RELATIONSHIPS: *Apiocera bilineata* appears to be most closely related to *sonorae* but can be easily distinguished by its primarily or entirely white pilose dististyles, gray pruinose body, femora partially or entirely piceous, shorter posterior tarsal pulvilli (fig. 70) and widely disjunct distribution (map 5). *A. sonorae* has the pile on the dististyles primarily or entirely black or brown, the body is tan pruinose, all legs are unicolorous testaceous, the tarsal pulvilli are long-

er (fig. 68) and it occurs in northwestern Sonora about 400 miles west of Samalayuca (map 6).

Apiocera bilineata (map 5) occurs geographically, ecologically, and chronologically together with *rockefelleri* (map 7) at Villa Ahumada but is only distantly related. *Apiocera rockefelleri* lacks the long recumbent pile on the median projection of the ninth abdominal sternite, the median projection is convex, and broadly overlaps the dististyles laterally, the dististyles are widely separated ventrally in the apical third and the inner margins are without incisions (see fig. 13), the inner surface of the locking folds are without dense pads of short erect hairs (see fig. 33), the claspettes are strongly arched dorsoventrally, the ventral subapical lobes are a continuation of the dorsal surface, the apex of the proctiger is vertical and with dorsal acute spines, and the dark dorsolateral abdominal markings are sublunate. In *bilineata* the median projection of the ninth abdominal sternite is sparsely clothed with long recumbent pile, the median projection is narrow and does not overlap the dististyles laterally (see fig. 16), the inner dististyle margins are deeply incised postmedially (see fig. 14), the inner surface of the locking folds are clothed with short erect dense hairs (see fig. 34), the claspettes are weakly arched laterally, the ventral subapical lobes are strongly differentiated from the claspette surface and are medium in length and straight, the apex of the proctiger is posteriorly and laterally oriented and lacks dorsal sharp spines and the dorsolateral dark abdominal markings are elongate, narrow, and linear.

21. *Apiocera sonorae* Cazier Figures 34, 40, 68; Map 6

Apiocera sonorae Cazier, 1954, pp. 7-8.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura bare; dististyles primarily or entirely black pilose, narrowly irregularly separated ventrally from wide postmedian transverse incisions in inner margins of dististyles to near apex; posterior tarsal pulvilli narrow, less than half as long as claws (fig. 68); black lateral abdominal markings evident and sim-

ilar on segments two through four, brown on segment five, absent on segments six and seven; median posterior projection of ninth sternite with long recumbent pile extending posteriorly from basal margin to postmedian incision in inner dististyle margins (see fig. 14); dististyles black pilose; body tan pruinose; legs unicolorous testaceous. Terminalia: Interior. Claspettes medium in length, slightly curved; inner interbasal folds with single deep dorsoapical emargination (fig. 40); inner surface of hemitergite locking folds densely clothed with short erect dark hairs over more than half the surface (fig. 34).

FEMALE: Abdominal dorsolateral dark maculations longitudinal, elongate, oblong, dorsal and ventral margins subparallel, usually narrow; dorsocaudal angle of mesopleura bare; costal wing vein white pilose; long ventrolateral macrochaetae on posterior tarsi entirely white, without midventral short black macrochaetae.

TYPE LOCALITY: 20 miles southwest of Sonoyta, Sonora, Mexico, June 13, 1952, R. Schrammel, W. Gertsch, M. Cazier. Holotype male, allotype female in the collection of the American Museum of Natural History, New York.

DISTRIBUTION: Mexico: Sonora: La Choya, June 12, 1952, R. Schrammel, W. Gertsch, M. Cazier; Puerto Penasco, June, 1960, E. Kirschbaum; 39 miles north Puerto Penasco, June 4, 1968, N. Leppla, J. Bigelow, J. Davison, M. Cazier; 5 miles south Riito, June 5, 1968, N. Leppla, J. Bigelow, J. Davidson, M. Cazier. United States: California: Imperial County: 17 miles northwest Glamis, June 27–28, 1978, D. and J. Powell.

ECOLOGY: The type series was found on sparsely vegetated sand hills where they were running around on the open sand and hiding in the shade of vegetation during the heat of the day. At 39 miles north of Puerto Penasco the situation and their behavior was much the same as at the type locality except that they were using the grass, *Hilaria rigida* (Thurber) Benth and dead *Lycium* sp., for shade. At 5 miles south of Riito they were found in a dune area in which there were standing pools of water. The dunes were loosely consolidated with creosote-bush,

Larrea tridentata; mesquite, *Prosopis juliflora* (Swartz) DeCandolle; bur-sage, *Franseria* species; and joint-fir, *Ephedra* species. The flies were using these plants for shade during the heat of the day and were visiting damp sand apparently to drink.

RELATIONSHIPS: See *bilineata* for a general discussion. *Apiocera sonora* (map 6) occurs geographically, ecologically and chronologically together with *caloris* (map 10) and *aldrichi* (map 9) at 5 miles south of Riito and is sympatric with *caloris* at Puerto Penasco. The three species are, however, only distantly related. *Apiocera sonora* can be distinguished from both *caloris* and *aldrichi* by having the inner dististyle margins apposed in the apical third (see fig. 14), by having long recumbent pile on the posterior extension of the ninth sternite (see fig. 14), by the patch of short erect hairs on the inner surface of the locking folds (fig. 34), by the short ventral subapical lobes on the claspettes, and by its longitudinal dorsolateral abdominal dark maculations. In *aldrichi* and *caloris* the inner dististyle margins are widely separated in the apical third (figs. 16, 21), there is no long recumbent pile on the median projection of the ninth sternite (figs. 16, 21), the inner surface of the locking folds are glabrous (see fig. 33), the ventral subapical lobes on the claspettes are long and sinuous, and the dark abdominal maculations are transverse.

22. *Apiocera rubrifasciata*, new species

Figures 30, 69; Map 6

DIAGNOSIS: Medium-sized, narrow; pteropleura bare, white pruinose in front of metathoracic spiracles; dististyles closed for short distance posterior to deep wide transverse incisions (fig. 30), narrowly open from this point to divergent apical tips; posterior tarsal pulvilli narrow (fig. 69), about half as long as claws; black lateral abdominal markings evident and similar on segments two through four, red or brown on segment five, reddish on segments six and seven.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex between

and behind ocelli with few white hairs; antennal segments one and two yellowish, white pruinose, pilose and macrochaetose, segment three bare, light-colored basally, dark apically, ending apically in short acute tooth; palpi white pruinose and pilose; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about one and one-half times the diameter of a lateral ocellus. Thorax with pronotal angles white pruinose, pilose and macrochaetose; mesonotum gray pruinose, markings tan pruinose, surface sparsely brown pilose, marginal and submarginal macrochaetae and pile white; mesopleura white pruinose, sparsely white pilose, dorsocaudal angle without pile or macrochaetae; wings with costal margin white pilose from base to apical one-quarter; scutellum gray and tan pruinose, sparsely white pilose, posterior margin with small and large lateral white macrochaetae. Legs with coxae white pruinose, pilose and macrochaetose; femora and tibiae testaceous, white pruinose, pilose and macrochaetose; tarsi white pilose, primarily white macrochaetose, ventral surface with few scattered black macrochaetae; hind tarsal pulvilli narrow, about half as long as claws, smaller than anterior and middle pulvilli (fig. 69). Abdomen with segment one gray and tan pruinose, basal middorsal spot golden pruinose, pile white, subapical margin with both white and black macrochaetae laterally; segment two sparsely brown pilose, tan pruinose except for dark areas and basal golden pruinose transverse band bordered on each side with black pits, middorsum in basal half with darker tan to golden pruinosity, dorsolateral black wide longitudinal band extending from near base almost to apical margin, lower margin straight, upper margin convex; segments three and four tan pruinose dorsally, dorsolateral dark markings as in segment two except continuous between segments, segment three sparsely brown and white pilose, segment four white pilose; dark markings on segments two through four brown pilose; segment five through seven white pruinose and pilose dorsally, dorsolateral nonpruinose

bands brown on segment five, reddish on six and seven; ventral and pleural areas of all segments white pruinose and pilose. Terminalia: Exterior. Light reddish brown; hemitergites sparsely brown pilose, nonpruinose, apical margin turned sharply inward, extending posteriorly into acute point, inner apical margin continuous with posterior locking fold margin; dististyles white pilose medially, sparsely brown pilose basally and on inner apical margin, apex moderately densely black pilose, without distinct subapical flare of hair, inner margin deeply widely incised at apical third, incision extending transversely almost to middle of dististyle (fig. 30), margin anterior to and posterior to incision moderately densely black pilose, shallowly emarginate beginning at posterior angle of incision and extending to about middle of posterior inner margin, apical margin evenly rounded (fig. 30); median projection of ninth sternite black and white pilose basally, apical margin of base with long black hairs extending posteriorly to incisions of dististyles, partially covering basal opening between dististyles and narrow rounded inturned apical portion of median projection. Terminalia: Interior. Hemitergites with large dense tuft of short black pile on posterior ventral surface of locking fold, elongate indistinct diagonal tuberculate area in middorsal half posterior to base of locking fold; locking fold subapical, prominently protruding from surface, lower margin straight medially not reaching lower margin of hemitergite; proctiger prominently and gradually widened from postmedian constriction to base, apical extensions extending from middorsal membranous opening (which is posterior to constriction) apically then abruptly curved downward on each side of the aedeagus, postmedian lateral arms extending outward and downward beneath aedeagus supporting a membrane suspended between them and beneath the aedeagus; claspettes flattened laterally, concave internally, extending upward and posteriorly at a 45-degree angle, base rounded and wide, basal margin strongly produced downward and wide for basal two-thirds, narrowly constricted to rounded curved apex, posterior angle on ventral margin with fanlike arranged

long curved golden hairs, inner dorsal margin with basal tuft of long golden pile, apical two-thirds with evenly spaced downcurved long golden pile, subapical ventral lobe long and extending downward and backward, base sparsely clothed with long black pile, apical two-thirds with few short stout bristle-like golden hairs; interbasal folds not extending into ventral opening, apex appearing bifurcate, outer acute point originating as a toothlike projection of inner posterior margin of transverse incisions in dististyles (fig. 30), extending vertically cradling the interbasal fold posteriorly, apical arm of interbasal fold (inner branch of seeming bifurcation) extending inward and upward forming the lower margin of the broadly open subapical rounded opening, upper arm expanded apically. Length 19.5 mm.; mesonotal width 4.5 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. Abdominal segment four with dorsal retrorse pile white, segment five with dorsal retrorse pile brown and white, venter brown, segments six and seven with brown retrorse pile throughout, segments one through four white pilose beneath, segments five through seven without dorsolateral markings; 11 apical digging spines on each side of genital opening; tarsal pulvilli small and narrow, less than half the length of the tarsal claws. Length 22 mm.; mesonotal width 5.5 mm.

TYPE MATERIAL: Holotype male, allotype female, seven male and five female paratopotypes collected at Bahia Santa Maria, 24 miles south of San Felipe, Baja California Norte, Mexico, July 9, 1973 by E. Fisher and R. Westcott. One of the male paratopotypes is mounted beneath a female robber fly, *Efferia candida* Coquillett, determined by E. Fisher. It is given as a predator of *rubrifasciata*. Two female paratypes were collected at Laguna Percibu (about 15 miles south of San Felipe) Baja California Norte, Mexico, July 4, 1970 by D. S. Verity (E. Fisher collection).

Holotype male and allotype female deposited in the collection of the California Academy of Sciences, San Francisco by E. M. Fisher. Paratopotypes and paratypes are in the collections of E. M. Fisher, Riverside,

California; Arizona State University, Tempe; and the American Museum of Natural History, New York.

ETYMOLOGY: From the Latin *rubrica* meaning red or reddish and *fasciata*, meaning banded in reference to the red lateral abdominal markings on segments six and seven.

ECOLOGY: The specimens were collected on the beach in depressions in the sand.

VARIABILITY: The 16 specimens show comparatively little variability in the major characters. Some males have the long hairs on the median projection of the ninth sternite primarily golden with only a few of the shorter basal hairs black. Of the five males in which the hemitergites and dististyles were opened, four have the hairs on the base of the subapical ventral lobes of the claspettes golden. Only the holotype has them black. The digging spines in the females vary from 10–12 on each side and unlike the males the tarsal pulvilli are small and equal sized on all legs. Two females have a few short brown hairs in the vicinity of the median ocellus below the vertex and on the lateral pronotal angles. The abdominal dark markings in the females vary from forming almost a complete fasciae between segments two through four to having them widely separated between segments. In one specimen the dorsolateral dark markings on segment four are indistinct.

RELATIONSHIPS: *Apiocera rubrifasciata* was named for the dorsolateral reddish fasciae on abdominal segments six and seven, a character it shares in part with *draperae* Cazier. However, in the latter species segment five also has the dorsolateral fasciae red, whereas in *rubrifasciata* it is brown. In addition, *rubrifasciata* has the posterior tarsal pulvilli short and narrow (fig. 69) rather than broad and two-thirds the length of the tarsal claws (see fig. 71) and the ventral tarsal pile and macrochaetae are primarily white rather than brown or black as in *draperae*. *Apiocera rubrifasciata* can be separated from *sonorae* by its larger anterior and middle tarsal pulvilli, and by its partially white pilose dististyles.

Apiocera rubrifasciata (map 6) occurs geo-

graphically, chronologically and probably ecologically, together with *fisheri* Cazier (map 1) at Bahia Santa Maria. They are, however, only distantly related. *Apiocera rubrifasciata* can be distinguished by having the compound eyes separated from the lateral ocelli on the vertex by about one and one-half times the width of a lateral ocellus, the pronotal and mesonotal lateral macrochaetae are white, the abdomen has red dorsolateral maculations on segments six and seven, the inner surface of the locking folds are clothed with short dense erect hair (see fig. 34), the dististyles have their inner margins apposed and there is a wide deep postmedian incision in the inner margin (fig. 30), the claspettes are straight and the ventral subapical lobes are thin, moderately long, and slightly bowed; the apex of the proctiger is oriented laterally and posteriorly and there are no dorsal sharp spines. In *fisheri* the compound eyes are separated from the lateral ocelli on the vertex by less than the diameter of a lateral ocellus, the pronotal and mesonotal lateral macrochaetae are primarily black, the abdomen has no red maculations, the inner surface of the locking folds is bare or with a few scattered hairs (see fig. 33), the dististyles have their inner margins widely separated in the apical third and there is no postmedian incision in the inner margin, the claspettes are strongly arched dorsoventrally (see fig. 62), and the dorsal margin is lined with membrane rather than hair, the ventral subapical claspette lobes are thick and short, the apex of the proctiger is oriented upward and there are two sharp short spines on the apex of the upturned portion.

23. *Apiocera mexicana* Cazier

Figures 28, 115; Map 8

Apiocera mexicana Cazier, 1954, pp. 8–9.

DIAGNOSIS: Male: Small-sized, narrow; pteropleura bare anterior to metathoracic spiracles; dististyles closed ventrally in apical third from transverse postmedian incisions in inner dististyle margins to apex (fig. 28), apex with ventral subapical flare of long

hair extending beyond apex of terminalia (fig. 28); posterior tarsal pulvilli medium to broad, half or more than half as long as claws, dorsolateral spines on posterior tarsal segments one through four black; abdominal segments five through seven without wide red subquadrate dorsolateral bands, segments two through four with middorsal dark linear markings (fig. 115); median posterior projection of ninth abdominal sternite with long recumbent pile extending from basal margin almost to transverse postmedian incisions in inner dististyle margins; dististyles black pilose, margins of postmedian incisions narrowly separated (fig. 28). Terminalia: Interior. Claspettes with ventral subapical lobes medium in length, straight; inner interbasal folds with single deep dorsoapical emargination; inner surface of hemitergite locking folds densely clothed with short erect black bristle-like hairs.

FEMALE: Abdominal dorsolateral dark maculations longitudinal, elongate, oblong, usually narrow; dorsocaudal angle of mesopleura with disc bare; costal wing vein black and white pilose; long ventrolateral macrochaetae on posterior tarsi black, posterior tibiae primarily black macrochaetose.

TYPE LOCALITY. Veracruz, Veracruz, Mexico, June 20, 1951, P. D. Hurd, Jr. Holotype male, allotype female in the collection of the American Museum of Natural History, New York.

DISTRIBUTION: Mexico: Veracruz: Veracruz, April 29, 1962, F. D. Parker, L. A. Stange; 8 miles northwest Palma Sola, September 3, 1965, E. M. Fisher; Tecolutla, June 19, 1951, P. D. Hurd; Buen Pais Camp, 7 miles south of Salinas, April 23, 1953, Bechtel and Schlinger. Guerrero: Acapulco, June 16, 1935, A. E. Pritchard. Tamaulipas: Ciudad Madero, July 1, 1964, E. Fisher, D. Verity. United States: Texas: Matagorda County: Matagorda, July 31, 1953, Evans, Lin, Yoshimoto. Kenedy County: Sarita, August 6, 1976, Delgada, Venegas; at lat. 27°10'N, long. 97°40'W, Riskin Ranch, July 26, 1975, J. E. Gillaspay and Party; at lat. 27°11'N, long. 97°31'W, August 21, 1976, J. E. Gillaspay. Cameron County: Padre Island, May 6, 1938, C. B. Philip. Hidalgo or Brooks

County: Between Edinburg and Falfurrias, August 6, 1921, C. D. Duncan.

ECOLOGY: The only data available is in a communication from Dr. R. H. Painter who collected specimens, presumably near Veracruz, on the bare spaces among the vines and short plants just back of the beach on the Gulf of Mexico. Dr. E. I. Schlinger (*in litt.*) reports that the specimen from Buen Pais Camp was taken on the beach.

RELATIONSHIPS: *Apiocera mexicana* does not appear to be very closely related to any other species even though it is in the same key dichotomy with *rubrifasciata*. *Apiocera mexicana* is smaller than *rubrifasciata*, it does not have the dorsolateral reddish fasciae on abdominal segments six and seven, the dististyles are black pilose, the posterior tibiae are primarily black or brown pilose and macrochaetose and the costal wing vein has white pile along the outer edge and a sparse row of black hairs along the inner margin. In *rubrifasciata* the dististyles are black and white pilose, the posterior tibiae are primarily white pilose and macrochaetose and the costal wing vein is white pilose. So far as known, *mexicana* (map 8) is widely allopatric from other described species.

24. *Apiocera melanura* Cazier

Figures 27, 117; Map 6

Apiocera melanura Cazier, 1941, p. 611.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura bare anterior to metathoracic spiracles; dististyles closed ventrally from transverse postmedian incisions in inner margins to near apex (fig. 27), apices without subapical flare of long hair (fig. 27); posterior tarsal pulvilli broad, more than half as long as claws, posterior tibiae predominantly white macrochaetose; inner edge of subquadrate dorsolateral abdominal dark bands on segments two through four convex, inner and outer margins not subparallel, bands narrowly constricted between segments (fig. 117); median posterior projection of ninth abdominal sternite with long recumbent pile extending posteriorly from basal margin to postmedian incisions in inner dististyle mar-

gins; incisions wide (fig. 27). Terminalia: Interior. Claspettes with ventral subapical lobes median in length, straight; inner interbasal folds with single deep dorsoapical emargination (see fig. 39); inner surface of hemitergite locking folds densely clothed with short erect bristle-like dark hairs (see fig. 34).

FEMALE: Abdominal dorsolateral dark maculations longitudinal, elongate, oblong, narrow; dorsocaudal angle of mesopleura bare; costal wing vein primarily white pilose; long ventrolateral macrochaetae on posterior tarsi primarily black, posterior tibiae white macrochaetose.

TYPE LOCALITY: Gila Valley, Gila County, Arizona, July 29, 1933, F. H. Parker. Holotype male in the collection of the National Museum of Natural History, Washington, D.C.

DISTRIBUTION: Arizona: Graham or Pinal County: San Carlos Lake, July, D. K. Duncan. Graham County: Gila Valley, August 1 (no year), D. K. Duncan.

ECOLOGY: At Gila Valley the specimens were taken on white sand which is the only information available.

RELATIONSHIPS: See discussion under *infinita*. *Apiocera intonsa* (map 5) was described from San Carlos, which is only a few miles upstream from San Carlos Lake where *melanura* occurs (map 6), but there is no record of their being sympatric at either location and their seasons appear to be slightly different, September and July, respectively. In *melanura* the terminalia is piceous and the apex of the dististyles is not comate (fig. 27). In *intonsa* the terminalia is reddish testaceous and the apex of the dististyles is comate, with a dense subapical brush of long hair (see fig. 28).

25. *Apiocera infinita* Cazier

Figures 7, 29, 71, 116; Map 5

Apiocera infinita Cazier, 1941, pp. 613-614.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura bare anterior to metathoracic spiracles; dististyles closed or narrowly irregularly open from postmedian transverse

incisions in inner dististyle margins to near apex (fig. 29), apex without subapical flare of long hair (fig. 29); posterior tarsal pulvilli broad, more than half as long as claws (fig. 71), posterior tibiae predominantly white macrochaetose; abdominal dark maculation on segments two through four dorsolateral only, elongate, subquadrate, inner and outer margins subparallel, markings usually broadly continuous between segments (fig. 116); median posterior projection of ninth abdominal sternite with long black recumbent pile extending from basal margin to or beyond incisions in inner dististyle margins. Terminalia: Interior. Claspettes with ventral subapical lobes medium in length, straight; inner interbasal folds with single deep dorsoapical emargination; inner surface of hemitergite locking folds densely clothed with short erect bristle-like black hairs.

FEMALE: Abdominal dorsolateral dark maculations longitudinal, elongate, oblong, usually narrow; dorsocaudal angle of mesopleura bare; costal wing vein entirely or predominantly white pilose; long ventrolateral macrochaetae on posterior tarsi primarily black; posterior tibiae white macrochaetose.

TYPE LOCALITY: Blythe, Riverside County, California, September 16, 1938, F. H. Parker. Holotype male in the American Museum of Natural History, New York.

DISTRIBUTION: California: Imperial County: Haughtelin Lake, Bard, July 21–22, 1953, no collector; Palo Verde, July 11, 1966, elevation 245 feet, J. M. Davidson, M. Cazier; Bard, July 19, 1945, E. I. Schlinger. Arizona: Yuma County: 1 mile north Ligurta, July 27–30, 1967, J. H. and J. M. Davidson, M. Cazier; 3 miles west southwest Gadsden, Hunters Hole Road, July 14, 1969, J. Bigelow; 6 miles south Parker, September 5–6, 1967, S. C. Williams, M. Cazier and July 22, 1967, J. H. and J. M. Davidson, M. Cazier; 7 miles south Parker, July 9, 1966 and July 21, 1967, J. H. and J. M. Davidson, M. Cazier; Ehrenberg, July 18, 1978, W. B. Warner; McPaul Bridge at Gila River, elevation 160 feet, August 24, 1973, R. Garrison, M. Kolner. Mohave County: 6 miles southeast Needles, June 11–16, 1976, Bigelow and Birduo; Topock, June 7, 1960, A. S. Menke.

ECOLOGY: At Palo Verde specimens were found in a sandy vacant lot on the south edge of town among quail-brush, *Atriplex lentiformis* (Torrey) Watson, and on a man-made island in the Colorado River east of town, along a dirt road and on open sand from dredging operations that were surrounded by tamarisk shrubs, *Tamarix chinensis* (fig. 7). At 1 mile north of Ligurta they were in sandy areas in a wide dry river bed in which the main shade was provided by ironwood, *Oleña tesota* Gray. At 6 miles south of Parker they were found on relatively unconsolidated dunes in which there were occasional large thickets of mesquite, *Prosopis juliflora*, and a few smaller plants. A large irrigation canal traversed the area where most of the specimens were collected. Also, at this location, a few were found in a trash dump scattered among dense mesquite thickets where the sand was well compacted. At 7 miles south of Parker at the junction of two dirt roads in a low moist area of loose sand and alkaline soil, they were found running and hiding among dense arrow-weed, *Pluchea sericea* (Nuttall) Coville, and quail-brush, *Atriplex lentiformis*. At McPaul Bridge they were found on moist soil and at Ehrenberg they were along the bank of the Colorado River.

RELATIONSHIPS: *Apiocera infinita* appears to be most closely related to *melanura* but can be separated from it by its narrow post-median incisions in the inner dististyle margins (fig. 29), by having the inner and outer margins of the subquadrate dorsolateral abdominal vittae subparallel (fig. 116), and by its broadly continuous vittae between segments (fig. 116). In *melanura* the incisions are wide (fig. 27), the inner edges of the markings are convex and the two edges are therefore not subparallel (fig. 117) and the vittae are narrowly constricted between the segments (fig. 117). *Apiocera infinita* (map 5) occurs along or close to the Colorado River, whereas *melanura* (map 6) is known only from the Gila River Valley in Graham and Pinal Counties, Arizona.

Apiocera infinita (map 5) occurs geographically, ecologically and chronologically together with *aldrichi* (map 9) at 1 mile north

of Ligurta, at Palo Verde and 7 miles south of Parker. These two species are associated as above with *pearcei* (map 10) at 6 miles southeast of Needles. *Apiocera infinita* is also found associated with *intonsa* (map 5) at 6 miles south of Parker. *Apiocera infinita* and *aldrichi* are sympatric at Houghtelin Lake, Bard and Ehrenberg but the records for the former are in July and the latter in June. These differences probably represent collecting anomalies rather than differences in biological chronology between the species. Whether or not they occur together ecologically is not known since the collections were made by different people in widely separated years. Five species are sympatric at Blythe but at different times as follows: *Apiocera parkeri* (map 11), April; *pearcei* (map 10) and *caloris* (map 10) in May; *aldrichi* (map 9) in May, June, and July; *infinita* (map 5) in September. *Apiocera caloris* and *pearcei* occur also ecologically at Blythe.

Of the six species involved in the above associations only *infinita* and *intonsa* are somewhat closely related, at least more so than the other four which bear little resemblance to the above two. In *infinita* and *intonsa* the inner dististyle margins are apposed in the apical third (fig. 29), the median projection of the ninth sternite is sparsely clothed with long recumbent pile, the inner dististyle margins have postmedian incisions (fig. 29), the inner surface of the locking folds are densely clothed with short erect hair (see fig. 34), and the abdominal dark markings are dorsolateral and elongate (fig. 116). In *aldrichi*, *caloris*, *pearcei*, and *parkeri* the inner dististyle margins are widely separated in the apical third and lack the postmedian incision (fig. 16), the median projection of the ninth sternite lacks long recumbent pile (fig. 16), the inner surface of the locking folds lack the dense pad of hair (see fig. 33) and the abdominal dark markings are wide and transverse (fig. 111).

Apiocera infinita differs from *intonsa* by lacking the apical and subapical ventral flare of hair on the dististyles (fig. 29), by having the postmedian incision in the inner dististyle margins narrow (fig. 29) and by having the abdominal dark markings with the inner and

outer margins subparallel (fig. 116). In *intonsa* the dististyles have a prominent apical and subapical ventral flare of long hair (see fig. 28), the transverse incisions in the inner dististyle margins are wide (see fig. 27), and the dark abdominal markings have the inner margin convex (see fig. 117).

Apiocera aldrichi can be separated from *caloris*, *parkeri* and *pearcei* by the apical pair of horizontal dorsoventrally flattened falciform apposing sharp-pointed blades protruding from beneath the dorsum of the lateral shield of the proctiger and above the aedeagus (fig. 87), and the lateral margins of the median projection of the ninth sternite do not overlap the dististyles laterally (fig. 16). *Apiocera parkeri* differs from *caloris* and *pearcei* by having the lateral parchment-like extensions of the posterior median extensions of the ninth sternite with margins narrowly evenly rounded and narrowly overlapping the dististyles (fig. 22) and the proctiger is without or with a narrow subapical collar (fig. 93). In *caloris* and *pearcei* the lateral parchment-like extensions of the posterior extensions of the ninth sternite are wide and straight laterally and prominently overlap the dististyles laterally (fig. 21). *Apiocera caloris* can be separated from *pearcei* by its primarily white pilose terminalia and by having the dorsal margins of the proctiger angularly expanded medially (fig. 89). In *pearcei* the terminalia are entirely or primarily black pilose and the dorsal margins of the proctiger are gradually rounded medially.

One female specimen from Mesquite, Clark County, Nevada, August 30, 1959, F. D. Parker is tentatively placed with *infinita* until such time as males are available. The female has the ventrolateral tarsal macrochaetae black as in *infinita*, but the lunate abdominal dorsolateral dark markings are unlike those of either *infinita*, *intonsa*, or *melanura*.

26. *Apiocera draperae*, new species

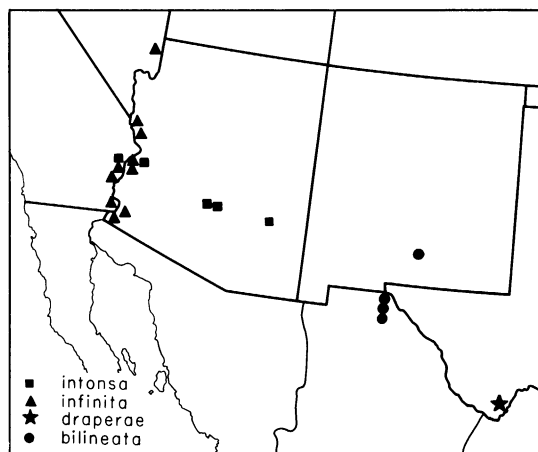
Map 5

DIAGNOSIS: Small-sized, narrow; pteropleura bare, white pruinose in front of meta-

thoracic spiracles; dististyles closed for short distance posterior to deep narrow postmedian transverse incisions, narrowly open from this point almost to divergent apical tips; posterior tarsal pulvilli broad, more than half as long as claws; dististyles of terminalia with ventral subapical flares of long brown to black hair extending beyond apex of terminalia; abdominal segments five through seven with wide red subquadrate lateral bands.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex behind lateral ocelli with few brown hairs; antennal segments one and two white pilose, pruinose and macrochaetose, segment three bare, light colored basally, dark apically, ending in short acute tooth; palpi white pruinose and pilose; posterior head surface white pilose, pruinose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about one and one-half times the diameter of a lateral ocellus. Thorax with pronotal angles light tan pruinose, white and brown pilose, white macrochaetose; mesonotum gray and tan pruinose, maculations brown pruinose, surface sparsely brown pilose, marginal and submarginal macrochaetae primarily white anterior to wing base, black and brown posteriorly, pile white; mesopleura white pruinose, sparsely white pilose, dorsocaudal angle bare, nonmacrochaetose; wings with costal margin white pilose from base to apical third; scutellum dark gray pruinose, sparsely white pilose, posterior margin black macrochaetose. Legs with coxae white pilose, pruinose and macrochaetose; femora and tibiae testaceous, white pruinose, pilose and macrochaetose; tarsi white pilose and macrochaetose dorsally, brown pilose and macrochaetose ventrally; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with segment one tan and white pruinose, basal middorsal spot golden pruinose, pile white, subapical margin black macrochaetose, longer and more dense laterally; segment two tan pruinose except for dark areas, basal margin with two transverse rows of black pits except for midbasal area, surface sparsely brown pilose, middorsal longitudinal golden pruinose line extending from base to slightly be-

yond middle, dorsolateral wide longitudinal black band extending from near basal margin to apical margin, lower edge nearly straight, upper edge shallowly convex; segments three and four tan and white pruinose, middorsal longitudinal golden pruinose line small, not reaching middle, pile short and brown, dorsolateral black bands as on segment two, forming an almost continuous band; segments five through seven white pruinose, primarily brown pilose, dorsolateral bands wide red nonpruinose sparsely brown pilose; ventral and pleural areas of all segments white pruinose and pilose. Terminalia: Exterior. Light reddish brown; hemitergites sparsely brown pilose, nonpruinose, apical margin turned sharply inward, extending posteriorly into an acute point; dististyles white pilose except for sparse brown basal hairs, inner apical margin and subapical flare of long black hair, inner margin deeply narrowly incised at apical third, incision extending transversely almost to middle of dististyle, inner margin shallowly emarginate beginning at posterior angle of incision and extending to about middle of posterior inner margin, apical margin evenly rounded; median projection of ninth sternite white pilose basally, apical margin of base with long black lateral hairs and long white median hairs extending posteriorly almost to incision in dististyles, covering (in part) the basal opening between dististyles and the narrow rounded inturned apical portion of median projection. Terminalia: Interior. Hemitergites with large dense tuft of black pile on posterior ventral surface of locking fold, elongate diagonal tuberculate area in middorsal half, anterior to base of locking fold; locking fold subapical, prominently protruding from surface, lower margin protruding medially into obtuse point not reaching ventral margin of hemitergite; proctiger prominently and gradually widened from postmedian constriction to base, apical extensions extending from middorsal membranous posterior opening (which is posterior to constriction) apically then abruptly curved downward on each side of the aedeagus, postmedian lateral arms extending outward and downward under aedeagus supporting a membrane suspended beneath and



MAP 5. Distributions of *Apiocera* sp.: *A. intonsa*, *infinita*, *draperae*, *bilineata*.

anterior to aedeagus; claspettes flattened laterally, concave internally, extending vertically from wide base and narrowing to rounded angulate apex, subapical ventral lobe long and extending horizontally toward apex, sparsely clothed with short stout bristle-like golden hair, base of claspette dorsally and ventrally with moderately dense long curved golden hairs; interbasal folds not extending into ventral opening, apex appearing bifurcate, outer curved projection originating under interbasal fold as an extension of the inner posterior margin of the transverse incision in dististyles, extending slightly beyond apex of interbasal fold, curved upward apically cradling the interbasal fold, apical arm of interbasal fold (inner branch of seeming bifurcation) extending upward and slightly inward, forming lower margin of membranous subapical rounded opening which is narrowly separated on inner margin. Length 17 mm.; mesonotal width 3.5 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The overall color is the same; the abdominal markings on segments two through four are similar, segment four has white retrorse pile, segments five through seven have no dorso-lateral red markings; the apical digging spines number nine on each side of the gen-

ital opening; the tarsal pulvilli are narrow and about half the length of the tarsal claws. Length 16 mm.; mesonotal width 3.5 mm.

TYPE MATERIAL: Holotype male, allotype female, 17 male paratopotypes and 11 female paratopotypes collected at Rio Grande Village, Big Bend National Park, Brewster County, Texas, June 22, 1970 by O. Francke, L. (Welch) Draper and M. Cazier. Three male and one female paratopotypes were collected August 18, 1968 by J. Bigelow and M. Cazier. Six male and one female paratopotypes were collected on June 16–17, 1974 by O. Francke, M. Cazier and Mrs. Linda (Welch) Draper.

Holotype male and allotype female are deposited in the collection of the American Museum of Natural History, New York. Paratopotypes are in the Arizona State University collection, Tempe.

ETYMOLOGY: This species is named after Mrs. Linda (Welch) Draper to express my appreciation for her untiring assistance and many valuable contributions to this project.

ECOLOGY: All 41 specimens were collected in two narrowly separated sandy areas within four to 30 feet of the waters edge of the Rio Grande River. The area opposite the improved camp ground was separated by about 200 feet from the downstream area below the limestone point by a gravel bar and a narrow springfed stream that entered the river at this point. In the upper habitat the flies were found primarily on loose tan sand that had been blown or washed in around the base of seep-willows, *Baccharis glutinosa* Persoon, salt-cedar, *Tamarix gallica* Linnaeus, and willows, *Salix gooddingii* Ball. In all three collecting periods the specimens were found closely associated with the shade offered by the above shrubs and small trees and appeared to prefer running from shade to shade rather than flying. In the June 22, 1970 visit to the area five pupal skins were found protruding from the sand between plants in the above described habitat. Adjacent to this area, going away from the river, was the preferred habitat of *franckei*, as described under that species, and both species were found together where the habitats changed. No evidence of hybridization is ev-

ident in the series of either species due probably to the fact that they are only distantly related at least morphologically. In the lower habitat on a gravel and sand bar *draperae* behaved much the same as given for the upper habitat in the sand under or next to the giant reed, *Arundo donax* Linnaeus, salt-cedar, *Tamarix gallica*, willow, *Salix gooddingii*, and in the shade on the river side of the mesquite, *Prosopis juliflora*, thicket that separated the habitat of this species from that of *femoralis*. No evidence of intermixing was found in this area.

VARIABILITY: In a few male specimens the long hairs on the median projection of the ninth sternite are all white instead of mixed black and white and in several the macrochaetae on the pronotal angles are yellowish or they have one or two black macrochaetae mixed in with the white. Otherwise the series is remarkably uniform. There is little or no variation in the male internal terminalia structures in the 23 dissected specimens.

RELATIONSHIPS: *Apiocera draperae* can be separated from *mexicana* by having white pile on the venter of the dististyles, by the red dorsolateral bands on abdominal segments five through seven and by its false bifurcate apex of the interbasal folds. From *intonsa* and *interrupta* it is distinguished by the red dorsolateral bands on abdominal segments five through seven and from *rubrifasciata* it differs by having the tarsal pulvilli broad and two-thirds the length of the claws and by its smaller size.

Apiocera draperae (map 5) occurs geographically and chronologically but not ecologically, together with *femoralis* (map 7) and *franckei* (map 7) at Rio Grande Village. For habitat division see ecological discussion under each species. *Apiocera draperae* can be distinguished from *femoralis* and *franckei* by having long recumbent pile on the posterior projection of the ninth abdominal sternite which is not expanded laterally (see fig. 14), by having the inner margins of the dististyles apposed for most of their length postmedially (see fig. 14), the apex of the dististyles have subapical long hair (see fig. 28), the claspettes are straight but oriented upward, and the inner surface of the locking

folds have a dense pad of short erect hairs (see fig. 34). *Apiocera femoralis* and *franckei* lack the long recumbent pile on the posterior projection of the ninth abdominal sternite (see fig. 13) which is widely expanded laterally and convex (see fig. 15), the inner dististyle margins are not apposed in the apical third (see fig. 13), the apex of the dististyles is not comate (see fig. 29), the claspettes are dorsoventrally arched (see fig. 62) and the inner surface of the locking folds is bare (see fig. 33). *Apiocera femoralis* can be separated from *franckei* by its darker pruinosity, by having the apex of the proctiger oriented upward, by lacking the dorsolateral projections from the dorsoapical margins of the proctiger (fig. 84) and by having middorsal markings on abdominal segments two through four (fig. 104). In *franckei* the pruinosity is white or cream colored, the apex of the proctiger is not oriented upward and has long curved lateral projections (fig. 81) and it lacks the heavy dark middorsal abdominal markings on segments two through four.

27. *Apiocera intonsa* Cazier

Figures 6, 59; Map 5

Apiocera intonsa Cazier, 1941, p. 610.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura with disc bare; dististyles closed ventrally from transverse postmedian incisions in inner dististyle margins to near apex (see fig. 14); posterior tarsal pulvilli broad, more than half as long as claws, dorsolateral macrochaetae on posterior tarsal segments one through four white, midventral macrochaetae on posterior tarsal segments two through four black; pile on exterior of terminalia black or brown; abdominal segments two through four without middorsal dark markings, segments five through seven without wide red subquadrate dorsolateral bands; median projection of ninth abdominal sternite with long recumbent pile extending posteriorly from basal margin to transverse incisions in inner dististyle margins (see fig. 14). Terminalia: Interior. Claspettes with ventral subapical lobes short thin and nearly straight (fig. 59); inner interbasal folds with single deep dorsoapical emargination (see



FIG. 6. Habitat *Apiocera intonsa, aldrichi*. Six miles south Parker, Yuma County, Arizona.

fig. 39); inner surface of hemitergite locking folds densely clothed with short erect bristle-like dark hairs (see fig. 34); anterior margin of emargination in inner interbasal folds strongly clavate (see fig. 40), not membranous laterally.

FEMALE: Abdominal dorsolateral dark maculations longitudinal, elongate, oblong, dorsal and ventral margins not subparallel, dorsal margin convex; dorsocaudal angle of mesopleura bare; costal wing vein white pilose; long ventrolateral macrochaetae on posterior tarsi entirely or primarily white.

TYPE LOCALITY: San Carlos, Gila County, Arizona, September 3, 1938, F. H. Parker. Holotype male in the American Museum of Natural History, New York.

DISTRIBUTION: Arizona: Maricopa County: At 3.2 miles southeast St. Johns, east of Sierra Estrellas, July 7, 10, 22, 1973, elevation 1050 feet, O. Francke, M. Kolner; Salt River Indian Reservation, September 10, 1964, J. D. Haddock. Yuma County: Six miles south Parker, September 6, 1967, S. C. Williams, M. Cazier, and July 22, 1967, J. H. and J. M. Davidson, M. Cazier. California:

San Bernardino County: Vidal, June 12, 1940, R. G. Dahl.

ECOLOGY: At 6 miles south of Parker a series was collected on relatively unconsolidated dunes in which there were occasional large thickets of mesquite, *Prosopis juliflora*, and a few smaller plants which supplied shade for the flies (fig. 6). A large irrigation canal traversed the area along the southwest side. At 3.2 miles southeast of St. Johns the flies were found at the base of a sand dune on white, dry soil between 9:00 and 11:30 A.M.

RELATIONSHIPS: See the discussions under *chiltonae*, *infinita* and *melanura*. *Apiocera intonsa* is closely related to the more western *interrupta*, but has the dististyle pile black or brown rather than white, the mid-ventral macrochaetae on the posterior tarsal segments two through four are entirely or predominantly black rather than white as in *interrupta*, and the subapical lobes of the claspettes are without spinelike short erect hairs as in *interrupta* (fig. 59).

Apiocera intonsa (map 5) occurs geographically, ecologically and chronologically

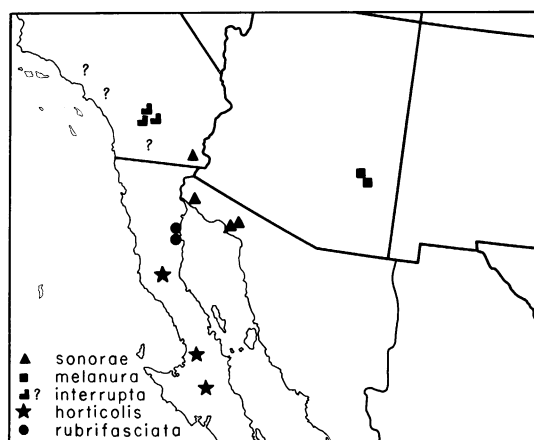
together with *aldrichi* (map 9) at 6 miles south of Parker but is only distantly related as indicated in the discussion of that species. *Apiocera intonsa* is sympatric with *pearcei* (map 10) at Vidal and both were collected in June, although nine years apart. *Apiocera intonsa* can be distinguished by having sparse long recumbent pile on the posterior extension of the ninth abdominal sternite (see fig. 14), the dististyles have a postmedian incision in the inner margins which are apposed in the apical third (see fig. 14), the apex of the dististyles have a subapical flare of long hair (see fig. 28), the locking folds have a pad of short dense erect hair (see fig. 34) and the dark abdominal markings are longitudinal and dorsolateral. *Apiocera pearcei* lacks the long recumbent pile on the median projection of the ninth abdominal sternite (see fig. 13), the dististyles have no postmedian incision, the inner margins are far apart in the apical third (see fig. 13), there is no subapical flare of hair, the locking folds are bare (see fig. 33) and the dark abdominal markings are transverse. *Apiocera intonsa* occurs geographically, ecologically and chronologically together with *chiltonae* at 3.2 miles southeast of St. Johns, but can be readily separated from it as discussed under the latter species.

28. *Apiocera interrupta* Painter

Figure 60; Map 6

Apiocera interrupta Painter, 1936, pp. 192–193.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura bare; dististyles white pilose, closed ventrally except for shallow emargination from postmedian transverse incisions in inner margins to near apex (see fig. 14), apices comate, with dense ventral subapical flare of long hair (see fig. 28); posterior tarsal pulvilli broad, more than half as long as claws, dorsolateral and midventral macrochaetae on posterior tarsal segments two through four white; abdominal segments two through four without middorsal dark linear maculations, segments five through seven without wide red subquadrate dorsolateral vittae; median posterior projection of ninth abdominal sternite with long recumbent pile



MAP 6. Distributions of *Apiocera* sp.: *A. sonorae*, *melanura*, *interrupta*, *horticolis*, *rubrifasciata*.

extending posteriorly from basal margin to postmedian incisions in inner dististyle margins (see fig. 14). Terminalia: Interior. Claspettes with ventral subapical lobes medium in length, thick, slightly bent, sparsely clothed with short bristle-like erect hairs (fig. 60); inner surface of hemitergite locking folds densely clothed with short erect bristle-like dark hairs (see fig. 34); anterior margin of emargination in inner interbasal folds strongly clavate (see fig. 40), narrowly membranous laterally.

FEMALE: Abdominal dorsolateral dark maculations longitudinal, elongate, oblong, narrow upper and lower margins subparallel, dorsocaudal angle of mesopleura bare; costal wing vein white pilose; long ventrolateral and midventral macrochaetae on posterior tarsi white; femora without dark subapical wide maculation.

TYPE LOCALITY: Los Angeles, California, D. W. Coquillett Collection. Holotype male, allotype female in the National Museum of Natural History, Washington, D.C., catalogue number 51432.

DISTRIBUTION: California: San Diego County (no specific location). Riverside County: Indio, August 5, 1935, J. Russell, J. Beamer, and September 19, 1946, J. Wilcox; 6 miles northwest Palm Springs, August 23, 1968, J. Wilcox; 2 miles east Palm Springs

Railroad Station, August 28, 1968, J. Wilcox; 7 miles northwest Palm Springs, September 7, 1971, J. Wilcox; Palm Springs Station, July 21, 1952, D. Shepherd, J. W. MacSwain. Ventura County: Ozena Forestry Camp, upper Cayama, August 19, 1967, C. W. Kirkwood.

ECOLOGY: No information available.

RELATIONSHIPS: For a general discussion see *intonsa*. *Apiocera interrupta* (map 6) occurs geographically, ecologically, and chronologically together with *wilcoxi* (map 1), *acuticauda* (map 2), and *pearcei* (map 10) at Palm Springs Station. For a comparison with *wilcoxi* and *acuticauda*, see the discussion under those species. *Apiocera interrupta* is only remotely related to *pearcei* and can be separated from it by its dorsolateral dark longitudinal abdominal maculations, by having the compound eyes separated from the lateral ocelli on the vertex by about twice the width of a lateral ocellus, by having long sparse recumbent hairs on the median projection of the ninth abdominal sternite (see fig. 14), by its transverse postmedian incision in the inner dististyle margins which are apposed in the apical third (see fig. 14), by its medium length ventral subapical claspette lobes (fig. 60) and by its pad of dense short erect hairs on the inner surface of the locking folds (see fig. 34). *Apiocera pearcei* has the dark abdominal maculations transverse, the compound eyes are separated from the lateral ocelli on the vertex by about the width or less than the width of a lateral ocellus, it lacks the long sparse recumbent hairs on the median projection of the ninth abdominal sternite (see fig. 13), the inner dististyle margins are widely separated in the apical third and lack the postmedian transverse incisions (see fig. 13), the ventral subapical claspette lobes are long and sinuous and it lacks the dense pad of short erect hairs on the inner surface of the locking folds (see fig. 33).

Apiocera interrupta is sympatric with *aldrichi* (map 9) and *trimaculata* (map 13) at Indio and may also occur ecologically and chronologically together with them but available data are insufficient to tell. *Apiocera trimaculata* was collected in April, *aldrichi* in June and *interrupta* in August. *Apiocera in-*

terrupta can be separated from both *aldrichi* and *trimaculata* by the same characteristics used above to separate *interrupta* from *pearcei*.

29. *Apiocera hamata*, new species

Figures 18, 62, 82. Map 10

DIAGNOSIS: Medium-sized, narrow; pteropleura bare anterior to metathoracic spiracles; dististyles open ventrally from apex of median projection of ninth sternite to convergent tips of dististyles (fig. 18); median projection of ninth sternite overlapping dististyles laterally for almost its entire length, surface strongly convex, median apical point turned upward (fig. 18); apex of dististyles extending straight back, outer subapical margins convex (fig. 18); terminalia piceous, venter entirely black and brown pilose; posterior femoral macrochaetae white; dorsolateral black markings on abdominal segments two through four widely separated, elongate subquadrate and linear; compound eyes separated from the lateral ocelli on the vertex by more than the diameter of a lateral ocellus; proctiger with long dorsolateral winglike apical arms, apical one-third of proctiger flattened dorsally (fig. 82).

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex pale yellowish pruinose, white pilose; antennal segments one and two white pruinose, pilose and macrochaetose, segment three dark, white pruinose basally, brown pruinose in apical half, ending in short acute tooth; palpi yellowish, white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about one and one-half times the diameter of a lateral ocellus; posterior head margin white pruinose, pilose and macrochaetose. Thorax with midpronotal area white pruinose, pilose and macrochaetose, lateral angles gray pruinose, black pilose and macrochaetose; mesonotum gray pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile brown and white mixed, macrochaetae white; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle sparsely white pilose, black macrochaetose;

wings with costal margin white pilose in basal half, black pilose apically; scutellum brown pruinose, black pilose, marginal macrochaetae black. Legs with coxae gray pruinose, white pilose and macrochaetose; femora piceous, sparsely gray pruinose, white pilose and macrochaetose; tibiae piceous, sparsely gray pruinose, anterior and middle pair white pilose and macrochaetose, posterior pair black and white pilose and macrochaetose; tarsi reddish brown, anterior and middle pair white pilose, black macrochaetose, posterior pair brown and white pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with three longitudinal rows of dark maculations; median dorsal brown pruinose elongate spots extending from basal margin to apical margin on segments one and two, not reaching apical margin on segments three and four; dorsolateral median large elongate black maculations on segments two through four with dorsal margins convex, ventral margins straight or shallowly concave, smaller dark areas on segments one and five; pleural maculations on segments two through four narrow brown and irregular along suture; dorsal pile brown, lateral and pleural pile white on segments one through four, pruinosity between maculations dark gray and brown; segment five gray pruinose, white pilose throughout; segments six and seven white pruinose and pilose; pleural area with wide gray pruinose longitudinal vittae separating pleural maculations from dorsolateral maculations; sternites gray pruinose, sparsely white pilose. Terminalia: Exterior. Piceous, sparsely black pilose throughout; hemitergites broad and short, dorsal margin with shallow emargination at about apical one-quarter, apex only slightly produced posteriorly, posterior margin curved inward and upward, exposing ventral and posterior portions of locking fold, evenly rounded to ventral curved margin; dististyles widened subapically, outer margin convex, apex bluntly pointed, open ventrally from median projection of ninth sternite to near apices, dorsal margin (when viewed from above) bent sharply outward at apical third (fig. 18); median projection of ninth sternite convex,

membranous lateral areas wide and broadly overlapping dististyles laterally for the entire lateral margin, apical marginal angles sharp, posterior margin subtruncate to median blunt upturned small projection, central triangular pointed area sparsely clothed with moderately long black hairs, not extending posteriorly to interbasal folds (fig. 18). Terminalia: Interior. Hemitergites with sparse black pile along dorsal margin and submargin behind emargination, apical margin thickened anterior to apex; locking fold shallowly elevated above hemitergite surface, gradually diverging from it and below ventral hemitergite margin, surface smooth shiny and shallowly concave, without convolutions, tuberculate area large, above anterior base of locking fold and anterior to emargination in dorsal margin, not reaching dorsal margin, bordered posteriorly with row of erect black hairs, beginning at lower inner attachment of locking fold to anterior end of thickening in dorsal margin apically; proctiger with dorsal margins sharply angulate above expansion into basal membrane, sharply constricted posteriorly to lateral membrane-like lateral expansions extending downward and slightly anteriorly on each side, widening slightly in descending portion, lateral expansions ending dorsally in small acute marginal teeth, from the lateral teeth the posterior extensions are flat dorsally, extending from median V-shaped notch, outward and posteriorly in a sweeping convex arc to a sharp point at right angles to proctiger, from the lateral point the margins extend anteriorly and inward in a less sweeping concave arc to the lateral teeth, flattened surface between margins wide and winglike, aedeagus ventral to lateral extensions (fig. 82); claspettes strongly arched dorsally from near base to apex, apex slightly extended and rounded, inner margin narrowly membranous medially, two hairs on margin anterior to membrane, one hair posteriorly, subapical ventral lobes long straight thick, margins subparallel, inner surface concave membranous, margins and outer surface sparsely short golden pilose (fig. 62); interbasal fold deeply emarginate apically in dorsal margin, upper edge sparsely golden pilose, lower pointed exten-

sion protruding prominently into ventral opening between dististyles (fig. 18). Length 19.1 mm.; mesonotal width 4.0 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics and in its lighter color. Abdominal dorsolateral dark maculations on segments two through four elongate, narrow, inner margins convex, outer margins straight, middorsal maculations indistinct; dorsocaudal angle of mesopleura with disc sparsely pilose and with one white macrochaeta; posterior surface of posterior tibiae white pilose, posterior femoral macrochaetae white; costal wing vein primarily white pilose. Length 17.2 mm.; mesonotal width 4.5 mm.

TYPE MATERIAL: Holotype male collected at San Ysidro, Sandoval County, New Mexico, June 18, 1973 by S. Szerlip. Allotype female collected 10.7 miles northeast Fabens, El Paso County, Texas, May 19, 1978 by O. F. Francke, J. V. Moody, and J. B. Hall.

PARATYPES: Texas, 10.7 miles northeast of Fabens, El Paso County, O. F. Francke, J. V. Moody, J. B. Hall, same data as allotype, 15 males, six females.

Holotype male deposited in the collection of the California Academy of Sciences, San Francisco, on an indefinite loan from the Esig Museum of Entomology, University of California, Berkeley. Allotype female deposited in the American Museum of Natural History, New York. Paratypes in the American Museum of Natural History, New York; Texas Tech University, Lubbock and in the Arizona State University collection, Tempe.

ETYMOLOGY: From the Latin *hamata*, meaning hooked, referring to the condition of the lateral apical proctigeal arms.

ECOLOGY: No information available.

VARIABILITY: Among the paratype males only one specimen is the size of the holotype, the other 13 specimens range from 18.1 mm. to 13.9 mm. with the majority at the lower end of the scale. Aside from the size variation the 15 paratype males are remarkably uniform in all the definitive characteristics. Three of the six paratype females are teneral but, aside from their lighter color-

ation, are like the hardened specimens in every respect.

RELATIONSHIPS: *Apiocera hamata* appears to be most closely related to *minckleyi* but is easily separated by its black rather than white pile on the dististyles of the terminalia and by its elongate rather than triangular dorsolateral black markings on abdominal segments two through four. In *hamata* the lateral apical proctigeal projections are evenly rounded outward instead of being sharply angulate at a 90 degree angle from the proctiger (fig. 82). In *hamata* the outer area of the lateral apical proctigeal projections have a flattened sclerotized membrane-like connection extending from near the tip anteriorly to the side of the proctiger where the lateral shields connect with it (fig. 82). At this juncture there is a small, sharply pointed lateral projection. In *minckleyi* there is no membrane in this outer angle between the lateral apical projections and the proctiger but there is a prominent sharply pointed, vertical projection at the base of each lateral apical projection where they meet with the lateral shield (fig. 80). In *hamata* the compound eyes are separated from the lateral ocelli on the vertex by more than the width of a lateral ocellus, whereas in *minckleyi* they are separated by less than one-half the width of a lateral ocellus.

From *franckei*, *hamata* can be distinguished by having its compound eyes separated from the lateral ocelli on the vertex by more than the diameter of a lateral ocellus, by its darker overall color, by its thicker and dorsally flattened lateral apical proctigeal arms (fig. 82) and by its elongate larger dorsolateral black markings on abdominal segments two through four. *Apiocera hamata* can be separated from *rockefelleri* by its elongate rather than triangular or lunate abdominal markings on segments two through four, by its flattened rather than vertical dorsoapical proctiger and by having lateral apical proctigeal arms which are absent in *rockefelleri* (fig. 82). At the present time, *hamata* (map 10) is allopatric with all other *Apiocera* species but eventually it should be found in association with other species along

the Rio Grande River drainage system. In addition to those species mentioned above, *bilineata* (map 5), *femoralis* (map 7), and *draperae* (map 5) are likely candidates for a closer geographical association with *hamata*, probably in the vicinity of El Paso, Texas.

30. *Apiocera franckei*, new species

Figure 81; Map 7

DIAGNOSIS: Medium-sized, moderately robust; pteropleura with a few short inconspicuous white hairs, surface gray pruinose; dististyles open ventrally from apex of median projection of ninth sternite to convergent tips of dististyles (see fig. 13); median projection of ninth sternite overlapping dististyles laterally for almost its entire length, surface strongly convex, posterior margin evenly rounded to blunt median point, strongly turned inward (see fig. 15); apex of dististyles straight, outer subapical margins convex; terminalia piceous, venter black pilose; pile on dorsum of abdominal segments six and seven white, surface tan pruinose, dorsolateral dark markings on segments two through four widely separated, not faintly and narrowly connected medially; pulvilli on posterior tarsi broad, two-thirds as long as claws; dorsolateral dark markings on abdominal segments three and four subtriangular, abdominal pruinosity tan; femora piceous, tibiae reddish brown.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex between ocelli dark, two longitudinal rows of dark pile behind inner margin of ocelli; antennal segments one and two white pruinose, pilose and macrochaetose, segment three bare, bicolored, pruinosity bitextured, fine and light brown at base, coarse and darker brown apically, apex ending in short acute tooth; palpi faintly yellowish, white pruinose, pilose and macrochaetose; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about one-half the width of a lateral ocellus. Thorax with pronotal angles tan

pruinose, white and brown pilose, black and white macrochaetose, primarily black; mesonotum brown pilose, markings tan and brown pruinose, marginal and submarginal macrochaetae black and white mixed, mesopleura gray purinose, sparsely white pilose, dorsocaudal angle white macrochaetose and pilose; wings with costal margin white pilose from base to apical third; scutellum tan pruinose basally, gray pruinose in apical half, white pilose, black and white macrochaetose along apical margin. Legs with coxae white pruinose, pilose and macrochaetose; femora piceous, gray pruinose, white pilose and macrochaetose; tibiae reddish brown, gray pruinose, anterior and middle tibiae white pilose, primarily white macrochaetose, hind tibiae brown pilose, black macrochaetose; anterior and middle tarsi white pilose, black macrochaetose, hind tarsi brown pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen white pilose laterally and ventrally, segment one gray pruinose laterally, median spot golden pruinose, pile white, subapical macrochaetae black; segment two gray and tan pruinose dorsally, white pilose except for brown pile on dorsomedian apical one-third, dorsolateral brown markings subtriangular, middorsal golden pruinose line extending from base to beyond middle; segments three and four tan pruinose, brown pilose dorsally, dorsolateral brown subtriangular spots larger than on segment two, middorsal golden pruinose line extending from base to middle; segments two through four with indistinct brown lateral longitudinal bands, not connected with dorsolateral dark spots; segment five with middorsal basal brown unpruinose spot and dorsolateral indistinct brown spot; segments five through seven white pruinose and pilose. Terminalia: Exterior. Piceous, brown pilose; hemitergites and dististyles without pruinosity; median projection of ninth sternite strongly brown pruinose in lateral thirds, lateral margins diverging from base to apical angles, apical margin bent strongly inward, median surface strongly convex, inverted V-shaped area black pilose. Terminalia: Interior.

Hemitergites without dense tufts of black pile, large tuberculate area in middorsal half, subapex shallowly dentate, apical projection black pilose; subapical locking fold heavily sclerotized, extending below lower edge of hemitergite, ventral margin shallowly convex; proctiger wide basally, narrowly constricted from middle to narrow winglike structures extending downward and backward around the aedeagus, apical arms curved outward and slightly backward at acute tips, dorsal base of apical arms each with short vertical acute projection (fig. 81); claspettes broad, concave internally, arched from base to apex, apex with small evenly rounded projection (see fig. 62), dorsal edge sparsely golden pilose, ventral subapical lobes short, sparsely golden pilose, concave on inner surface, continuous with claspette, apex angulate; interbasal folds projecting into opening between dististyles, acutely pointed, subapical emargination broadly open. Length 18.5 mm.; mesonotal width 4 mm.

FEMALE: Similar to the male except in the secondary sexual characteristics. Mesonotum with lateral macrochaetae white, surface with thick tan pruinosity, markings indistinct; costal wing vein white pilose from base to apical third; abdominal segments two and three with dorsolateral irregular dark spots, retrorse hairs on segment five brown dorsally and ventrally, white pleurally, brown on segments six and seven; legs reddish brown, coxae and femora tan pruinose, white pilose, anterior and middle tibiae white pilose, black and white macrochaetose, hind tibiae brown and white pilose and macrochaetose; anterior and middle tarsi brown and white pilose, brown macrochaetose, hind tarsi brown pilose and macrochaetose; pulvilli broad, two-thirds as long as claws; digging spines at apex of abdomen short blunt and brown, 11 on one side, 12 on the other side of the genital opening. Length 20 mm. (stretched to show spines); mesonotal width 5 mm.

TYPE MATERIAL: Holotype male and 67 male paratopotypes, allotype female and 16 female paratopotypes collected at Rio Grande Village, Big Bend National Park, Brewster

County, Texas, June 22–23, 1970 by L. (Welch) Draper, M. Cazier and O. Francke. Paratopotypes from the identical microhabitat as the holotype but dated August 18, 1968, J. Bigelow, M. Cazier, 45 males, four females; June 16–17, 1974, L. (Welch) Draper, O. Francke, M. Cazier, 25 males, 10 females.

PARATYPES: Texas: Valverde County: Langtry, June 9, 1974, L. (Welch) Draper, O. Francke, M. Cazier, two males. Pecos County: Sheffield, July 24, 1921, Carl D. Duncan, one male. According to the label this specimen was taken along the Pecos River. New Mexico: Don Ana County: 1 mile east of San Miguel, June 25, 1970, L. (Welch) Draper, O. Francke, M. Cazier, 11 males, three females.

Holotype male, allotype female and paratopotypes in the collection of the American Museum of Natural History, New York; paratopotypes and paratypes in the collection of Arizona State University, Tempe.

ETYMOLOGY: The species is named after Dr. Oscar Francke, Texas Tech University, Lubbock in appreciation for his valuable assistance in gathering much of the material used in this and other studies.

For many years specimens of this species have been incorrectly identified as *augur* whose type locality was given as "Mexico, Presidio (Forrer)." The assumption was evidently made that this Presidio referred to the Mexican side (Ojinaga) of Presidio, Presidio County, Texas. Selander and Vaurie (1962, p. 47) found that this Biologia Centralia-Americana location was near Mazatlan, Sinaloa, Mexico. Cazier (1963, p. 229) questioned the identity of the Texas, Chihuahua, Mexico, and New Mexican specimens as being conspecific, but left them with *augur* pending an examination of the type. The late Dr. Reginald H. Painter (*in litt.*, 1967) submitted the following: "When I visited the British Museum in 1964, I studied and took pictures of *Apiocera augur* Osten Sacken. The type is unquestionably not the same species as the specimens that I collected in Texas and New Mexico back in 1930." With the rediscovery of *clavator* Painter in Colima, Mexico, by Robert Lavigne (1975, p.

673) and the presence of one specimen referable to *augur* in the series, it seems reasonable to consider the two populations as being distinct, as indeed their morphological and distributional differences indicate. Upon reexamination of the material referred to by Cazier (1963, p. 230), specimens received from Painter and recently collected specimens from Texas and New Mexico, it has been found that not one but two new species are represented in this misidentified material from the eastern side of the Sierra Madre Occidental. These are herein named, *franckei* and *rockefelleri* whose differences and distributional data can be found in their descriptions.

ECOLOGY: The types and paratopotypes, a total of 169 specimens, were collected in rocky areas, on hard clay soil or light-colored dry soil in open or partially open areas adjacent to the Rio Grande River. Two males and three females were found emerging from the hard, light-colored clay soil about 40 feet from the river bank. The partially open areas were primarily in the vicinity of large mesquite, *Prosopis juliflora*, patches of seep-willows, *Baccharis glutinosa*, and salt-cedar, *Tamarix gallica*. The open areas were between creosote-bush, *Larrea tridentata*, or on gravel bars next to the river. Immediately adjacent to these areas inhabited primarily by *franckei* there were areas of loose sand or sand bars next to the river inhabited by another species, *draperae*. Both species fought for and shared the mixed habitat between their preferred types. The third species at this location, *femoralis*, occupied a third habitat type which was a few feet farther and higher from the river, but which appeared to separate it effectively from the other two. The habitat at San Miguel was in a dry open field next to the Rio Grande River and more especially in and near sand blowouts in the field. Specimens were also found on the dusty roads running between the field and adjacent cultivated land. Both specimens from Langtry were taken at the lights of a motor home parked near the edge of a 50 foot cliff overlooking the Rio Grande River. The shoreline consisted primarily of dense mesquite thickets with a few sandy

areas immediately behind. No specimens were taken in their natural habitat.

VARIABILITY: Specimens collected in 1968, 1970, and 1974 in the same identical unaltered microhabitats, exhibit no discernible morphological divergence and each of the three samples (49, 83 and 35 individuals) contains about the same amount and types of variability. In a few of the males the compound eyes are separated on the vertex by less than half the width of a lateral ocellus, there may be a few dark hairs between the three ocelli as well as behind them, the mesonotal macrochaetae may all be black, the dorsocaudal angle of the mesopleura may be brown pilose and in a few specimens both black and white macrochaetose. One male had the dorsolateral dark marking on abdominal segment two missing, two had a small dorsolateral dark marking and a lateral elongate dark band on segment five and a few specimens had sparse black dorsal hairs on segments five through seven. A few of the females have faint lateral dark marks on segments two and three, faint lateral and mid-dorsal dark markings on segments two through four, no white retrorse pile on the pleura of segment five and the front of the head is a deep tan pruinose. In all the specimens the pile on the costal wing vein is either entirely or predominantly white in the basal two-thirds. In the basal area where the white pile is longest there is quite often a dorsal row of short sparse black hairs on the vein at the lower edge of the thick white pile. The internal terminalia structures show little or no variability in the 104 male specimens in which the hemitergites and dististyles were opened for study.

RELATIONSHIPS: *Apiocera franckei* appears to be most closely related to *minckleyi*, but can be separated as given in the discussion of the latter species. *Apiocera franckei* (map 7) occurs geographically and chronologically together with *femoralis* (map 7) and *draperae* (map 5) at Rio Grande Village, but there is at least partial habitat division as discussed under ecology. *Apiocera franckei* can be separated from *femoralis* by its tan rather than gray pruinosity, by the primarily white pile instead of mixed black and white pile on

the costal wing margin. In *franckei* the apex of the proctiger is horizontal, the lateral apical arms curve gradually outward and anteriorly to a sharp point (fig. 81) and the inner dorsal claspette margins are narrowly membranous. In *femoralis* the apex of the proctiger is vertical and without lateral projections (fig. 84) and the dorsal inner claspette margins are not membranous. *Apiocera draperae* can be separated from both *franckei* and *femoralis* by many characters, such as, by its long recumbent pile on the median projections of the ninth abdominal sternite (see fig. 14), its apposed inner dististyle margins which have a postmedian incision (see fig. 14) and a ventral subapical flare of long hair (see fig. 28), by its pad of dense short erect hair on the inner surface of the locking folds (see fig. 34) and by the dorsolateral red maculations on abdominal segments five to seven.

31. *Apiocera minckleyi*, new species

Figure 80; Map 7

DIAGNOSIS: Medium-sized, narrow; pteropleura with a few short white hairs in front of metathoracic spiracles, surface gray pruinose; dististyles open ventrally from apex of median projection of ninth sternite to convergent tips of dististyles (see fig. 13), obscured by long white pile; median projection of ninth sternite overlapping dististyles laterally for almost its entire length, surface strongly convex, posterior margin evenly rounded to blunt median point, turned strongly inward (see fig. 15); apex of dististyles straight, outer subapical margins evenly rounded; terminalia black and piceous, ventral pile primarily white; tarsal pulvilli broad, more than half as long as claws; dorsolateral dark markings on abdominal segments two through four subtriangular; posterior femora and tibiae black or piceous; abdominal pruinosity gray.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex between and behind ocelli brown pilose; antennal segments one and two white pruinose, macrochaetose and pilose, segment three bare,

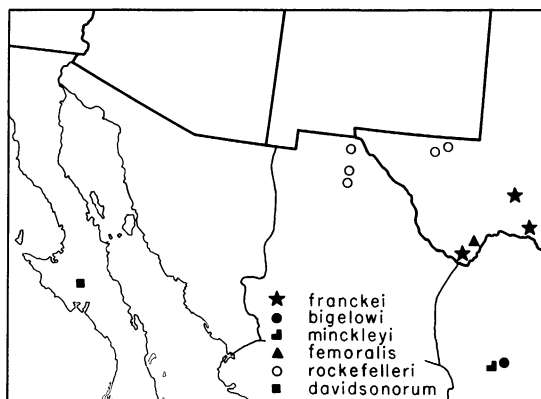
gray and brown pruinose, dark in upper half, ending in short acute tooth; palpi white pruinose and pilose; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by one-half the width of a lateral ocellus. Thorax with pronotal angles black macrochaetose, brown pilose, gray pruinose; mesonotum brown pilose, markings gray and tan pruinose, marginal and submarginal macrochaetae mostly black, mixed with few white in posterior one-third; mesopleura gray pruinose, white pilose, dorsocaudal angle (anterior to wing base) white and brown pilose, black macrochaetose; wings with costal margin white pilose from base to beyond middle; scutellum gray pruinose, white and brown pilose, black macrochaetose along posterior margin. Legs with ground color piceous; coxae gray pruinose, white pilose and macrochaetose; femora gray pruinose, anterior and middle pair white pilose, primarily white macrochaetose, hind femora with inner margin brown pilose, posterior margin black macrochaetose; anterior and middle tibiae white pilose, primarily black macrochaetose; tarsi brown pilose and macrochaetose. Abdomen with segment one and ventral surface and lateral margins of all segments white pilose, segments two through four sparsely brown pilose dorsally, segment five with few middorsal brown hairs; segments one through four gray pruinose, segments five through seven white pruinose dorsally; segment one with subapical row of fine black macrochaetae; segments two through four with dorsolateral subtriangular brown spots, increasing in size apically, segment five with indistinct lateral dark mark, segments two through four with middorsal basal golden line not reaching apex of segments and not connected with dorsolateral spots, segment five with middorsal basal black spot. Terminalia: Exterior. Hemitergites sparsely gray pruinose, black pilose above, bottom edge white pilose; dististyles sparsely gray pruinose, short black pilose in basal half, long white pilose apically and internally, upper edge from base to near apex widely glabrous for insertion in interlocking fold of hemitergites; median projection of ninth sternite strongly convex,

lateral margins evenly rounded, overlapping dististyles for almost their entire length, posterior margin evenly rounded to blunt median point, turned strongly inward, surface with median long hairs white at base, black and white apically. Terminalia: Interior. Hemitergites without dense tufts of black pile, line beneath tuberculate area with six black hairs, apex with moderately dense black pile; subapical locking fold heavily sclerotized, extending well below lower edge of hemitergite; proctiger with subapical wings extending down and backward, apex with deep median groove, lateral apical arms extending at a 90-degree angle laterally, not embracing the aedeagus, dorsal area at base of median groove with acute projections extending upward (fig. 80); claspettes arched from base to apex, sparsely golden pilose, apex bluntly rounded (see fig. 62), inner subapical lobes short broad, convex on inner surface, sparsely golden pilose; interbasal folds not projecting into opening between dististyles, acutely pointed at apex, subapical emargination broadly open. Length 17 mm.; mesonotal width 4 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics and its lighter color. Mesonotum with lateral macrochaetae white; legs reddish brown, coxae and femora tan pruinose, pilose and macrochaetose, tibiae with black and white macrochaetae mixed; abdominal segments two and three with dorsolateral elongate median dark spots, retrorse pile on segments four through six brown dorsally, white laterally and ventrally, segment seven black pilose throughout; digging spines at apex of abdomen short blunt brown with ten on each side of genital opening. Length 17.5 mm.; mesonotal width 4.5 mm.

TYPE MATERIAL: Holotype male and eight male paratopotypes, allotype female and nine female paratopotypes collected 5.6 miles southwest of Cuatro Cienegas, Cuatro Cienegas Basin, Coahuila, Mexico, August 8 and 11, 1968 by J. Bigelow and M. Cazier.

PARATYPES: Mexico: Coahuila: Cuatro Cienegas Basin: Chiqueros, August 11, 1968, J. Bigelow, M. Cazier, seven males, three females; Lomas de Churince, August 11,



MAP 7. Distributions of *Apiocera* sp.: *A. franckei*, *bigelowi*, *minckleyi*, *femoralis*, *rockefelleri*, *davidsonorum*.

1968, M. Bentzien, J. Bigelow, S. Williams, M. Cazier, four males, one female; one mile south of Posos de la Becerra, August 11–12, 1968, J. Bigelow, M. Cazier, 109 males, 12 females; Laguna Mesquitas, August 11, 1968, W. L. Minckley, one male, one female, not paratyped because of their poor condition.

Holotype, allotype and paratypes in the collection of the American Museum of Natural History, New York; paratopotypes in the Arizona State University collection, Tempe.

ETYMOLOGY: The species is named after Dr. W. L. Minckley, Arizona State University, Tempe in grateful acknowledgment of his being the first to discover *Apiocera* in the Cuatro Cienegas Basin.

ECOLOGY: All 19 paratopotypes were collected in the deeply eroded, semistabilized dunes, near the cemetery, and on moist sand adjacent to a man-made canal that resembled a stream in this location. The Chiqueros specimens were collected on recently disturbed, graded, sandy loam away from any water. The specimens from Lomas de Churince were collected on moist soil near a canal. All 121 specimens from Posos de la Becerra were taken in an open sandy area near a drying saltwater pool, sparsely covered with low vegetation which offered shade for the flies.

VARIABILITY: In the type series of 155 specimens there is some variability in certain definitive characters even though the distributional range is relatively small and confined to the Cuatro Cienegas Basin. In the holotype the pteropleura has a few fine white hairs, whereas in most other specimens this structure is bare. In some specimens the legs and terminalia are reddish brown instead of piceous due to the teneral condition of the specimens at the time they were killed. In the holotype the dorsocaudal angle of the mesopleura is white and brown pilose, black macrochaetose. This varies to being only white pilose, and the macrochaetae may be mixed white and black, to white only or missing completely. The abdominal dark markings range from the pattern given for the holotype through a series of variations ending with segments two through four having dark lateral linear bands; the dorsolateral markings on segment two may be narrowly connected with the median brown line which is very wide, on segment three they are still more widely connected and on segment four even more widely connected forming a broad "W." Segments five to seven, in heavily maculated individuals, have lateral brown areas and indistinct median dark lines. In the females the number of digging spines surrounding the genital opening varies from 10–13 on each side. The male terminalia structures are remarkably uniform both externally and internally in the 33 specimens in which the hemitergites and dististyles were opened.

RELATIONSHIPS: *Apiocera minckleyi* appears to be most closely related to *franckei*, but can be separated from it in a number of features. *A. minckleyi* is gray pruinose instead of tan, its legs are black or piceous instead of reddish brown or testaceous, the terminalia pilosity is predominantly white instead of entirely brown or black. The distributional ranges of *minckleyi* and *franckei* are disjunct by about 125 airline miles and in *minckleyi* the dorsal hairs on abdominal segments three and four are long and white, whereas in *franckei* they are short black and posteriorly recumbent. Both species have the internal terminalia structures similar in having the proctiger with lateral apical arms. In *minck-*

leyi these arms extend laterally at right angles to the axis of the proctiger and protrude straight out to a sharp point (fig. 80). In *franckei* the lateral arms are gradually curved outward and anteriorly to a sharp point (fig. 81).

The only other species of *Apiocera* known from the Cuatro Cienegas Basin is *bigelowi* (map 7) which is narrowly, about 100 yards, allopatric from *minckleyi* (map 7) even though the preferred habitat of both is seemingly continuous. *Apiocera minckleyi* can be distinguished from *bigelowi* by having its compound eyes separated from the lateral ocelli on the vertex by half or less than one-half the diameter of a lateral ocellus, instead of by about the diameter of a lateral ocellus as in *bigelowi*. *Apiocera minckleyi* has a dorsolateral and middorsal spotted abdominal dark pattern on segments two through four, in *bigelowi* the dark maculations are in transverse median bands. In *minckleyi* the terminalia are primarily white pilose instead of all brown or black. *Apiocera minckleyi* has lateral apical arms on the proctiger, it has two dorsal acute short subapical vertical projections near the base of the lateral projections (fig. 80) and the dorsal interior claspette margins are narrowly membranous. In *bigelowi* there is no membranous lining on the dorsal interior margin of the claspettes (fig. 65) and there are no dorsolateral arms or dorsal sharp projections on the proctiger (fig. 83). *Apiocera bigelowi* can be separated from *minckleyi* and all other known species of *Apiocera* by its unique proctiger, the apex of which is broadly expanded laterally and the wide apical margin is deeply evenly emarginate anteriorly between the posteriorly projecting sharp lateral angles (fig. 83). This gives it an inverted U-shaped appearance with the concave surface facing posteriorly.

32. *Apiocera bigelowi*, new species

Figures 15, 65, 83; Map 7

DIAGNOSIS: Medium-sized, narrow; pteropleura bare in front of metathoracic spiracles, surface white pruinose; dististyles

closed ventrally over entire length, without transverse incision at apex of median projection of ninth sternite (fig. 15); abdominal segments two through four with wide transverse postmedian uninterrupted dark dorsal bands; long hair on base of costal wing vein white; median projection of ninth sternite strongly convex, overlapping dististyles laterally for its entire length except for posterior margin which is bent inward, clothed with wide, median inverted V-shaped band of long black hair (fig. 15).

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex between and behind ocelli brown pilose; antennal segments one and two white pruinose, macrochaetose and pilose, segment three bare, gray and brown pruinose, dark in upper portion, ending in short acute tooth; palpi faintly yellowish, white pruinose and pilose; posterior head surface white pruinose, macrochaetose and pilose; compound eyes separated from lateral ocelli on vertex by about the width of a lateral ocellus. Thorax with pronotal angles gray and brown pruinose, brown pilose, black macrochaetose; mesonotum brown pilose, markings tan and brown pruinose, marginal and submarginal macrochaetae black and white mixed; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle brown and white pilose, nonmacrochaetose; wings with costal margin white pilose from base to apical third; scutellum gray pruinose, white and brown pilose, black macrochaetose. Legs with ground color piceous; coxae gray pruinose, white pilose and macrochaetose; femora gray pruinose, brown and white pilose, anterior and middle femora black and white macrochaetose, posterior femora black macrochaetose beneath; tibiae gray pruinose, anterior and middle tibiae white pilose, black macrochaetose, hind femora brown pilose, black macrochaetose; anterior tarsi brown and white pilose, black macrochaetose, middle and hind tarsi brown pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with segment one gray pruinose except for brown median pruinose spot, white pilose in basal two-thirds and laterally, apical third brown

pilose, subapical margin with row of black macrochaetae; segment two gray pruinose basally and apically, postmedian narrow transverse dorsal dark marking connected to median longitudinal wide golden brown line extending from base to apical margin of transverse vitta, not to apical margin of segment, pile on dark markings and apical gray margin brown and sparse; segment three gray pruinose basally and apically, postmedian narrow transverse dorsal dark marking slightly depressed medially, extending almost to lateral spots, narrow middorsal longitudinal golden brown line extending from base of segment to basal margin of transverse vitta, pile on disk, dark markings and gray apical margin sparse and brown, otherwise white pilose; segment four with wide brown transverse band covering apical half of segment except apical gray pruinose margin and basal wide tan pruinose margin, narrow golden middorsal line extending from base of segment into basal margin of transverse brown band, pile sparse and brown except for basal white pile; segment five with dorsolateral narrow golden transverse lines not connected medially; segments five through seven white pruinose, basal pile white, sparse midapical pile black; segments two through four with irregular small lateral dark markings; segments one through five white pilose ventrally, segments six and seven sparsely black pilose ventrally. Terminalia: Exterior. Piceous; hemitergites and dististyles without pruinosity, sparsely black pilose; median projection of ninth sternite strongly brown pruinose in lateral thirds, lateral margins diverging from base to apical angles. Terminalia: Interior. Hemitergites without dense tufts of black pile, subcylindrical tuberculate area in middorsal half, apex acutely pointed; subapical locking fold heavily sclerotized, extending below lower edge of hemitergites, margin straight ventrally; proctiger narrow in basal two-thirds, narrowly constricted behind winglike subapical expansion which extends downward and forward, apex with dorsum widely expanded, each edge extending slightly posteriorly and strongly downward as arms on each side but not touching the aedeagus, in-

ner pair of arms inside of and below dorsal expansions extending posteriorly and downward on each side of aedeagus (fig. 83); claspettes broad, flattened, arched from base to apex, apex with small evenly rounded projection, upper edge with few median golden hairs, ventral subapical lobes short, nearly glabrous, concave on inner surface, continuous with claspette, apex angulate (fig. 65); interbasal folds not projecting to inner edge of dististyles, acutely pointed apically, subapical emargination broadly open. Length 19.5 mm.; mesonotal width 3 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics and its lighter tan color. Mesonotum with lateral macrochaetae primarily white, surface with thick loose pruinosity; scutellum and abdominal segments two through four densely loosely pruinose, immaculate; retrorse hair on abdominal segments five through seven black; legs reddish brown, coxae, femora and tibiae densely and loosely tan pruinose, coxae and femora white pilose, primarily white macrochaetose, anterior and middle tibiae brown and white pilose, black macrochaetose, posterior tibiae brown pilose, black macrochaetose, tarsi brown pilose, black macrochaetose; pulvilli broad, two-thirds as long as claws; digging spines at apex of abdomen short blunt and brown with nine on each side of genital opening. Length 18.5 mm.; mesonotal width 4 mm.

TYPE MATERIAL: Holotype male and 41 male paratopotypes, allotype female and 13 female paratopotypes collected 1 mile southeast of Cuatro Ciénegas, Cuatro Ciénegas Basin, Coahuila, Mexico on August 12, 1968 by M. Bentzien, S. Williams, J. Bigelow and M. Cazier.

Holotype, allotype and paratopotypes in the collection of the American Museum of Natural History, New York; paratopotypes in the Arizona State University collection, Tempe.

ETYMOLOGY: The species is named in honor of J. Bigelow to partially express my appreciation for his tremendous assistance in gathering much of the material used in this and other studies.

ECOLOGY: All 56 specimens were taken in open sandy areas between clumps of mesquite, *Prosopis juliflora*, along dusty dirt roads and on moist dirt where a road forded a canal.

VARIABILITY: Although the type series appears to be fairly uniform in appearance there is some variability. The dorsocaudal angle of the mesopleura may be all white pilose, but in a few specimens from one to three black macrochaetae are present. The marginal mesonotal macrochaetae vary from being almost all white to being all black. In two of the 56 specimens there are a few black hairs mixed with the white ones at the base of the costal wing margin and the white pilosity does not extend to the middle of the wing. On a few specimens there are faint dorsolateral brown marks on segments five and six, the dorsal transverse dark bands may be narrowly or widely connected to the lateral spots on segments two through four, and segments five through seven may be white pilose both dorsally and ventrally. The internal features of the terminalia show little structural variability in the 24 specimens in which the hemitergites and dististyles were opened. In one specimen the subapical lobe of the proctiger had a few short golden hairs on the outer surface. In the females, especially in those in which some of the pruinosity has been rubbed off, there are indistinct irregular brown spots on abdominal segments two and three and a middorsal dark line is evident on segments two through five. The number of digging spines varies from eight to 11 on each side of the genital opening.

RELATIONSHIPS: *Apiocera bigelowi* (map 7) can easily be distinguished from all other known species by its proctiger (fig. 83). The apex of the proctiger is horizontal, not tilted upward, and the posterior margin is broadly expanded laterally and is deeply emarginate anteriorly between the posteriorly projecting sharp lateral angles. This gives the apex an inverted U-shaped appearance with the concave surface facing posteriorly. From *minckleyi* (map 7) with which it is sympatric in the Cuatro Ciénegas Basin, it can be separated as given in that species.

33. *Apiocera femoralis*, new species

Figures 84, 104; Map 7

DIAGNOSIS: Medium-sized, narrow; pteropleura bare, gray pruinose in front of metathoracic spiracles; dististyles open ventrally from apex of median projection of ninth sternite to convergent tips of dististyles; median projection of ninth sternite overlapping dististyles laterally for almost its entire length, surface strongly convex, posterior margin evenly rounded to blunt median point, often turned inward; apex of dististyles straight, outer subapical margins convex; terminalia black and piceous, venter black and brown pilose; abdominal segments six and seven with dorsal short pile brown and black, surface gray pruinose, dorsolateral dark markings on segments two through four narrowly or widely connected medially (fig. 104); hind femora black, macrochaetae black.

DESCRIPTION: Male: Head with front white pruinose and pilose (slightly rubbed in part), vertex between and behind ocelli brown pilose; antennae piceous, segments one and two white pruinose, pilose and macrochaetose, segment three bare, black and piceous pruinose, black in upper half, ending in short acute tooth; palpi pale yellow, white pruinose and pilose; posterior head surface gray and white pruinose, white pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about one-half the width of a lateral ocellus. Thorax with pronotal angles gray pruinose, white and brown pilose, black macrochaetose; mesonotum gray pruinose, faint maculations brown pruinose, surface brown pilose, marginal and submarginal macrochaetae black, pile white; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle brown and white pilose, nonmacrochaetose; wings with costal margin black and white pilose basally, black pilose from long basal hairs to apex; scutellum gray pruinose, brown pilose, black macrochaetose. Legs with coxae gray pruinose, white pilose and macrochaetose; femora black, gray pruinose, anterior and middle pairs white pilose, black macrochaetose, posterior pair brown

pilose, black macrochaetose; anterior and middle tibiae reddish brown, primarily brown pilose, macrochaetae black, posterior tibiae piceous, brown pilose, black macrochaetose; tarsi reddish brown, brown pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with segment one gray pruinose except for mid-basal golden pruinose spot, white pilose basally and laterally, brown pilose apically and dorsolaterally, subapical margin black macrochaetose; segments two through four gray pruinose except for dorsal dark markings, brown pilose; segment two with narrow basal transverse golden pruinose band bordered on each margin by black foveae, middorsal longitudinal golden pruinose line extending from base to apical third, dorsolateral subtriangular black markings extending inward to sides of middorsal longitudinal golden pruinose line, not reaching base, apical or lateral margins; segments three and four with large black dorsolateral subtriangular markings broadly connected middorsally, median golden pruinose line extending from base of segment to basal margin of black dorsal markings, black markings not reaching margins of segment; segments five through seven gray pruinose middorsally, dorsolateral irregular dark markings reaching apical margins of segments, decreasing in size from segment five to seven, faint middorsal longitudinal broken line on each segment, brown pilose above; segments two through four with narrow, longitudinal dark bands, not connected to dorsolateral black markings; segments one through five white pilose ventrally; segments six and seven black pilose ventrally. Terminalia: Exterior. Black and piceous; hemitergites and dististyles without pruinosity, sparsely black pilose; median projection of ninth abdominal sternite faintly gray pruinose basally, strongly concave, lateral third bare, pruinosity piceous, lateral margins evenly rounded from base to lateral apical angles, widest at about middle, posterior margin truncate to median short acute projection, middle third of surface with inverted V-shaped black pilose area extending from base to median projec-

tion of apical margin. Terminalia: Interior. Hemitergites without dense tufts of black pile, subcylindrical tuberculate area in mid-dorsal half above base of locking fold; apex bluntly rounded; subapical locking fold heavily sclerotized, lower margin almost straight, slightly concave medially, extending below lower edge of hemitergite, not strongly angulate from surface; proctiger narrowly widened at base, membranous laterally, narrowly constricted at apical third, widened apically and bent upward at about a 45-degree angle, narrowed toward apex, posterior surface narrow, vertical parallel-sided dorsal angles extending vertically into two needle-like projections, ventral angles without lateral projections, extending downward on each side of the aedeagus (fig. 84); claspettes broad, flattened laterally, inner surface concave, enlarged at base and apex, arched from base to apex and bent inward toward middle, subapex with small evenly rounded projection, subapical lobes short, extending inward and downward from rounded projection, concave, membranous, acutely pointed, dorsal claspette surface sparsely clothed with golden hairs, ventral surface near base with long evenly spaced curved golden pile; interbasal folds extending slightly into ventral opening between dististyles, acutely pointed at apex, subapical emargination broadly open. Length 18 mm.; mesonotal width 3.5 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The overall color is a light tan rather than dark gray; the mesonotal marginal and submarginal macrochaetae are primarily white; the abdominal markings on segments two through four are subtriangular, dorsolateral and not connected medially; the legs are light reddish brown and testaceous; the retrorse hairs on abdominal segments five through eight are black dorsally and ventrally; tarsal pulvilli slightly narrower and shorter than in the male; digging spines on apex of abdomen short blunt and black, 11 on one side and 10 on the other. Length (abdomen extended) 22 mm.; mesonotal width 4.5 mm.

TYPE MATERIAL: Holotype male, allotype female, 32 male paratopotypes and three fe-

male paratopotypes collected at Rio Grande Village, Big Bend National Park, Brewster County, Texas, June 23, 1970 by O. Francke, L. (Welch) Draper, and M. Cazier. Seven male and four female paratopotypes collected June 16-17, 1974 by L. (Welch) Draper, O. Francke and M. Cazier. One male paratype (teneral) collected 10 km. south of Villa Ahumada, Chihuahua, Mexico, August 1-2, 1974 by E. M. and J. L. Fisher.

The holotype and allotype are deposited in the collection of the American Museum of Natural History, New York. Paratopotypes are in the Arizona State University collection, Tempe. Paratype in the collection of E. M. Fisher, Riverside, California.

ETYMOLOGY: From the Latin *femoris*, meaning thigh to emphasize the black femora characteristic of this species.

ECOLOGY: All 48 specimens from the type locality were collected on a rocky slope that extended from a lookout peak through the nature trail area into a flat sandy opening separated from the Rio Grande River by a dense thicket of mesquite trees, *Prosopis juliflora*. The slope consisted of gray limestone outcrops with little soil or sand, whereas the flat area above and back of the river was made up of wind-blown sand, both loose and consolidated. The vegetation both on the slope and the sandy flat consisted of scattered creosote-bush, *Larrea tridentata*, a few white-thorn acacia, *Acacia constricta* Benth, a few Engelmann prickly-pear, *Opuntia engelmannii* Salm-Dyck, scattered tar-bush, *Flourensia cernua* De Candolle, a few ocotillo, *Fouquieria splendens* Engelm, a number of species of cactus (Cactaceae), and such annuals as indian-mallow, *Abutilon incanum* (Link) Sweet, and desert marigold, *Baileya multiradiata* Harvey and Gray. No specimens of *femoralis* were found on the river side of the mesquite thicket, an area with quite different characteristics occupied by *draperae*.

VARIABILITY: There is comparatively little variability, at least in the basic characters. In one specimen the brown pile on the vertex of the head extends down the front between the ocelli and slightly below the median ocellus. The marginal and submarginal mesono-

tal macrochaetae vary from being all black as in the holotype to being black and white mixed. In two specimens the long hair at the base of the costal wing vein is all white and some white hairs extend along the vein to the apical one-third of the wing. Except for two teneral specimens the femora are all black, an almost unique condition for which the species is named. In the teneral specimens the femora are piceous and in a third specimen the hind femoral macrochaetae are primarily white instead of black. In one specimen there is a lateral dark mark on segment five and in three specimens the dark dorsal transverse bands on segments two through four are narrowly separated medially. The internal structures of the terminalia show little structural variability in the 35 specimens in which the hemitergites and dististyles were opened. The main variation in the females is in their length which in unextended individuals varies from 11 to 19 mm. and in individuals whose abdomens had been extended, as in oviposition, it varied between 18.5 and 22 mm.

RELATIONSHIPS: *Apiocera femoralis* appears to be closely related to *rockefelleri*, as indicated in the key, but can also be separated by its more proximate inner ventral dististyle margins, by the evenly rounded outer subapical dististyle margins and by its predominantly black pilose costal wing vein. *Apiocera femoralis* (map 7) occurs geographically, chronologically, and partially ecologically together with both *draperae* (map 5) and *franckei* (map 7) at Rio Grande Village, but all three are readily separated as discussed under *franckei*.

34. *Apiocera augur* Osten Sacken

Figures 46, 63; Map 8

Apiocera augur Osten Sacken, 1887, pp. 212–213.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura with moderate to dense long white pile anterior to metathoracic spiracles; dorsocaudal angle of mesopleura with one or more strong black macrochaetae in addition to hair; median projection of ninth sternite convex, not extending posteriorly to apical third of dististyles or posteriorly to or be-

yond transverse portions of interbasal folds, overlapping dististyles laterally; posterior tibiae predominantly black or brown macrochaetose; compound eyes separated from lateral ocelli on vertex by more than one-half the width of a lateral ocellus; terminalia brown or piceous pruinose; abdominal segment four with dark dorsal markings, sternites two through four white pilose; outer dististyle margins shallowly excavated subapically (fig. 46). Terminalia: Interior. Interbasal folds with deep elongate diagonal emargination in subapical dorsal margin (fig. 46); dorsal inner claspette margins with complete membranous lining, arcuate dorsoventrally (fig. 63); proctiger without lateral horn-like apical projections; inner dististyle margins without postmedian incisions, margins not apposed ventrally from apex of median projection of ninth sternite to near apex.

FEMALE: Unknown.

TYPE LOCATION: Presidio, Mexico (Forrer). Holotype male in the collection of the British Museum of Natural History, London, England. For many years this type location was presumed to be near Presidio, Presidio County, Texas, but as a result of a paper by Selander and Vaurie (1962, p. 47) this Biologia locality is now known to be near Mazatlan, Sinaloa, Mexico.

DISTRIBUTION (map 8): Mexico: Colima?: Escamillas, May 8, 1973, Robert Lavigne. The single male closely matches the description of *augur* and the photographs of the type that were made available by Dr. R. H. Painter.

ECOLOGY: No information available.

RELATIONSHIPS: *Apiocera augur* appears to be the only species that has the outer subapical dististyle margins distinctly but shallowly emarginate (fig. 46). From *clavator*, it can be easily separated by its dorsoventrally arched claspettes (fig. 63), by the upturned apex of the proctiger, its straight dististyles (fig. 46), and short, median basal muscle attachment on the base of the inner hemitergite surface. In *clavator* the claspettes are straight, the apex of the proctiger is not turned upward, the apices of the dististyles are bent sharply inward (fig. 17) and the muscle attachment on the inner hemitergite sur-



MAP 8. Distributions of *Apiocera* sp.: *A. augur*, *clavator*, *mexicana*.

face extends along the ventral half of the surface almost to the subapical locking fold, a character which seems to be unique in this species. There are many other differences and the two species are only distantly related.

From *fisheri*, with which it seems to be more closely related, it can be separated by its darker color, transverse abdominal maculations, black pilose terminalia, more widely separated compound eyes, by its elongate deep emargination in the dorsoapical margin of the inner interbasal fold (fig. 46), the rounded ventroapical projection of the inner interbasal fold (fig. 46) and by its primarily black pile on the costal wing vein. In *fisheri* the color of the abdomen and legs are reddish brown instead of black, the abdominal maculations are dorsolateral, the terminalia are white pilose, the compound eyes are separated from the lateral ocelli on the vertex by about one-half the width of an ocellus, the emargination in the dorsoapical margin of the inner interbasal fold is deep and round (fig. 47), the ventroapical projec-

tion of the inner interbasal fold is long and sharply pointed (fig. 47) and the costal wing vein is white pilose throughout.

Apiocera augur (map 8), although allopatric according to the present records, may eventually be found with *clavator* (map 8) in the vicinity of the Colima-Jalisco border near El Centinela. *Apiocera augur* is also allopatric with the more closely related *fisheri* (map 1) which is known only from northern Baja California, Mexico.

35. *Apiocera fisheri*, new species

Figure 47; Map 1

DIAGNOSIS: Large-sized, moderately robust; pteropleura bare, tannish pruinose in front of metathoracic spiracles; dististyles open ventrally from apex of median projection of ninth sternite to convergent tips of dististyles; median projection of ninth sternite overlapping dististyles laterally for almost its entire length, surface shallowly convex, posterior margin evenly rounded to blunt median point, turned inward; apex of dististyles straight, outer subapical margins evenly rounded (fig. 47); terminalia piceous, ventral pile white; posterior tarsal pulvilli narrow, half or less than half as long as claws; dorsolateral dark markings on abdominal segments three and four irregular, round or elongate spots.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex tan pruinose, with row of short brown hairs along inner margin of each lateral ocellus extending slightly in front of and behind ocelli; antennal segments one and two yellowish, white pruinose, pilose and macrochaetose, segment three bare, yellowish basally, brown apically, ending apically in a short acute tooth; palpi white pruinose and pilose; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about one-half the width of a lateral ocellus. Thorax with pronotal angles tan pruinose, brown and white pilose, black macrochaetose; mesonotum tan pruinose, median markings gray pruinose, surface sparsely brown pilose except for few median basal white hairs,

marginal and submarginal macrochaetae black and white mixed, pile white; mesopleura light tan pruinose, sparsely white pilose, dorsocaudal angle with sparse tuft of white pile, gray pruinose; wings with costal margin white pilose in basal two-thirds; scutellum tan pruinose, white pilose, posterior margin black macrochaetose. Legs with coxae gray pruinose, white pilose and macrochaetose; femora and tibiae piceous, gray pruinose, anterior femora white pilose, black and white macrochaetose, middle femora white pilose, black macrochaetose, hind femora brown and white pilose, black macrochaetose; anterior and middle tibiae white pilose, black macrochaetose, hind tibiae brown pilose, black macrochaetose; tarsi reddish brown, brown pilose and macrochaetose; tarsal pulvilli narrow, about half as long as claws. Abdomen mottled gray pruinose, segment one white pilose, subapical margin with row of black macrochaetae; segment two white pilose basally and laterally, brown pilose medially and apically, middorsal irregular dark marking in basal half, dorsolateral small irregular dark mark slightly postmedian; segments three and four brown pilose dorsally, white pilose laterally, markings as on segment two but slightly larger; segments five through seven brown, immaculate, white pilose; ventral and pleural surfaces of all segments tan pruinose, white pilose. Terminalia: Exterior. Piceous basally, reddish brown apically, white pilose, gray pruinose; hemitergites with moderately dense white pile longest apically, apex pointed, not bent inward; dististyles uniformly long white pilose, inner margin without postmedian incision, open ventrally from apex of median projection of ninth sternite to convergent tips of dististyles, inner margin with long white hairs extending over and partially obscuring opening between dististyles; median projection of ninth sternite bare laterally, median inverted V-shaped bare area lined laterally with long white hair, lateral margins overlapping dististyles for almost their entire length, apical margin evenly rounded to median projection, bent sharply inward. Terminalia: Interior. Hemitergites with subapical row of black hair posterior and dorsal to apex of

locking fold, tuberculate area above middle of locking fold, base of locking fold with row of black hair (five on one side, six on the other) immediately above and extending slightly posteriorly, locking fold not strongly sclerotized, semitransparent, lower margin strongly arcuate from base to apex, extending below lower hemitergite margin, surface without hair tuft; proctiger narrowly constricted medially, abruptly widened anteriorly, sides parallel to base, posterior extension membranous medially, projecting vertically at about a 45-degree angle, sides wide at bottom, narrowing upward, ending in acute dorsal tooth, posterior surface inclined at a 45-degree angle downward and anteriorly, membranous medially, lower lateral extensions on each side of aedeagus; claspettes strongly arched from base to apex, concave internally, upper inner margin from near base to apical one-quarter lined with membrane, apical one-half of membrane with sparse golden hair on inner margin, apex enlarged, subapical posterior margin with short rounded projection, apex pointing downward and slightly toward base, inner margin golden pilose; interbasal fold acutely pointed apically, pointing downward and inward into ventral opening between dististyles, subapical emargination rounded narrow and deep (fig. 47). Length 21.5 mm.; mesonotal width 5 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. Upper third of head front tan pruinose, sparsely black pilose from below median ocellus to vertex and laterally from compound eye to compound eye, back of head with one black macrochaeta mixed with white. Abdominal segments two through four with dorsolateral slightly elongate dark spots, marking on segment four gray pruinose medially. Femora and tibiae reddish brown, hind femora and tibiae white pilose, black macrochaetose, tarsal pulvilli small narrow about one-third the length of a tarsal claw. Digging spines 12 on each side of genital opening. Length 23 mm.; mesonotal width 6 mm.

TYPE MATERIAL: Holotype male, allotype female, 10 male paratopotypes, and eight female paratopotypes collected at Bahia Santa

Maria, 24 miles south of San Felipe, Baja California Norte, Mexico, July 9, 1973 by E. Fisher and R. Westcott.

Holotype male and allotype female deposited in the collection of the California Academy of Sciences, San Francisco by E. M. Fisher. Paratopotypes are deposited in the collections of E. M. Fisher, Riverside, California; Arizona State University, Tempe; and the American Museum of Natural History, New York.

ETYMOLOGY: The species is named after Mr. E. M. Fisher in grateful acknowledgment of the valuable material he supplied for this study.

ECOLOGY: No information available.

VARIABILITY: In the 20 specimens there is some variability in several characters in both the males and females. In the males a few specimens have the front of the head tan pruinose like the females, the sparse black pile on the front extends from the vertex to slightly below the median ocellus and in one specimen there are two brown macrochaetae among the dorsal white ones on the back of the head. The dorsocaudal angle of the mesopleura has one black macrochaeta and a few of the hairs are brown in one specimen and in another there is one white macrochaeta in this area. In two specimens the middle and hind coxae have one brown macrochaeta each. The pile on the terminalia varies from being all white to having that on the dorsum of the hemitergites and the base of the dististyles brown in one specimen. In the females the entire front of the head may be tan pruinose, the sparse black pile may extend from the vertex to about the middle of the front, the back of the head dorsally may have from one to three macrochaetae or as in one specimen all the dorsal macrochaetae are black or brown. In one specimen antennal segments one and two each have from three to five black or brown macrochaetae. The marginal and submarginal mesonotal macrochaetae may be primarily white, all black or a mixture of both and in two specimens the pile on the base of the costal wing vein is mixed black and white, and in one almost half and half. In one specimen the middle and hind coxae have brown, black

and white macrochaetae, the latter being more numerous. The internal structures of the male terminalia show little structural variability in the six specimens in which the hemitergites and dististyles were opened.

RELATIONSHIPS: *Apiocera fisheri* appears to be most closely related to *franckei*, *linsleyi linsleyi*, *minckleyi* and *rockefelleri* with which it shares at least two basic structural characteristics. All five of these species have the claspettes strongly arched dorsoventrally from the base to the apex and the ventral margin of the locking fold on the inside surface of the hemitergites extends below the ventral margin of the hemitergites. From *linsleyi linsleyi* and its subspecies *linsleyi obliqua*, it can be separated by its short, narrow tarsal pulvilli. From *minckleyi*, *franckei*, and *rockefelleri* it can be distinguished by its flat rather than convex median projection of the ninth abdominal sternite. In general appearance it resembles no other species. *Apiocera fisheri* (map 1) occurs sympatrically with *rubrifasciata* (map 6) at Bahia Santa Maria, but the two are abundantly distinct as given in the discussion of the latter.

36. *Apiocera chiltonae*, new species

Figures 41, 49, 64, 86; Map 1

DIAGNOSIS: Medium-sized, narrow; pteropleura with four white hairs on one side and one long one on the other, densely gray pruinose in front of metathoracic spiracles; dististyles open ventrally from apex of median projection of ninth sternite to convergent tips of dististyles; median projection of ninth sternite overlapping dististyles laterally for almost its entire length, surface strongly convex, evenly rounded apically and abruptly constricted medially to blunt point, margin turned sharply inward; apex of dististyles straight, outer subapical margins straight (fig. 41); terminalia light reddish brown.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex grayish pruinose, brown pilose between lateral ocelli; antennal segments one and two white pruinose, pilose and macrochaetose, segment three bare, yellowish basally, brown apically, ending apically in a short acute tooth; pal-

pi yellowish, white pruinose and pilose; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about two-thirds the width of a lateral ocellus. Thorax with pronotal angles gray pruinose, white pilose and macrochaetose; mesonotum light gray pruinose, markings dark gray pruinose, discal sparse short hairs brown, marginal and submarginal pile and macrochaetae white; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle with sparse tuft of white pile, nonmacrochaetose, gray pruinose; wings with costal margin white pilose in basal two-thirds; scutellum gray pruinose, white pilose and macrochaetose. Legs with coxae gray pruinose, white pilose and macrochaetose; femora piceous, mottled gray pruinose, white pilose and macrochaetose; tibiae reddish brown, anterior and middle pairs white pilose and macrochaetose, posterior pair brown pilose, brown and white macrochaetose; tarsi brown pilose and macrochaetose; tarsal pulvilli broad, posterior pulvilli about half as long as claws, anterior and middle pairs broader than posterior and about two-thirds as long as claws. Abdomen mottled gray pruinose, segment one white pilose, subapical margin with row of black macrochaetae; segments two through four with dorsolateral small irregular golden pruinose spots, faintly connected dorsally on segments two and three, widely separated on four, narrow middorsal longitudinal golden pruinose line extending from base to middle, connected to transverse band on segments two and three, dorsal surface sparsely brown pilose; segments five through seven with middorsal irregular longitudinal bare bands, white pilose laterally; ventral and pleural surfaces white pilose on all segments. Terminalia: Exterior. Light reddish brown; hemitergites sparsely brown pilose dorsally, ventral margin sparsely white pilose, subapical margins constricted inward to blunt narrow apex, ventral subapical margin deeply emarginate; dististyles white and brown pilose, subapical pile long, inner margin without postmedian incision, open ventrally from apex of median projection of ninth sternite to convergent tips of dististyles; median

projection of ninth sternite strongly convex, bare laterally, median inverted V-shaped area bordered laterally with long black and white hairs mixed, lateral margins overlapping dististyles for almost their entire lengths, apical margin gradually converging medially to blunt apical point, marginal area gradually bent inward. Terminalia: Interior. Hemitergites with sparse black pile on subapical dorsal border, median base of locking fold with six widely spaced hairs; tuberculate area oblong, above basal half of locking fold; locking fold strongly protruding from inner hemitergite surface, semitransparent, lower margin obtusely angulate medially, extending below lower hemitergite margin, surface without hair tuft; proctiger narrowly constricted postmedially, narrowing posteriorly into membrane, angulate vertically behind constriction, ending dorsally in a rounded knob, ventral V-shaped projection extending from sides of knob downward and forward beneath widened base of proctiger, apical margin vertical, membranous median portion extending ventrally on both sides of aedeagus, small lateral arms below dorsal knob protruding outward and upward with tips touching base of knob forming a window-like opening on each side when viewed posteriorly (fig. 86); claspettes strongly arched from base to apex, concave internally, upper inner margins at top of arch with membranous lining, subapical posterior margin with short rounded projection and acute inner angle, subapical ventral lobe extending downward toward each side of aedeagus, ending in sharp point, sparsely clothed with golden hair at base, few scattered hairs on dorsal surface (fig. 64); interbasal fold obtusely rounded apically, pointing prominently inward into ventral opening between dististyles (fig. 41), posterior margin without subapical emargination (fig. 49). Length 18 mm.; mesonotal width 4.5 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The head and thorax are tan pruinose, the antennal segments are tan pruinose, the legs are reddish brown and the femora have piceous median longitudinal stripes, the tarsal pulvilli on all legs are small, less than half the length

of the claws, the abdominal markings on segments two through four are not connected dorsally, the median longitudinal lines are indistinct, there are 10 digging spines on each side of the genital opening. Length 20 mm.; mesonotal width 4.5 mm.

TYPE MATERIAL: Holotype male, allotype female, 67 male paratopotypes, one female paratopotype collected in East Phoenix, Maricopa County, Arizona, June 11–30, 1969 by members of the Chilton family. Additional paratopotypes: June 15, 1969, Cazier and Chilton families, 29 males, one female; June 10, 1969, one male, June 18, 1970, five males, June 14, 1968, one male, Beverly Chilton; June 16, 1969, J. Bigelow, 43 males.

PARATYPES: Arizona: Maricopa County: Tatum Boulevard, Scottsdale, June 16, 1970, B. Chilton, one female; 3.2 miles southeast Saint Johns, July 7, 1973, 1050 feet elevation, M. Kolner, J. Alcock, 12 males, four females; same location, July 10, 1973, O. Francke, M. Kolner, 27 males, nine females; 18 miles south Gila Bend, July 6, 1966, J. Davidson, M. Cazier, two males.

Holotype male and allotype female deposited in the collection of the American Museum of Natural History, New York. Paratopotypes and paratypes in the Arizona State University collection, Tempe; and the American Museum of Natural History.

ETYMOLOGY: The species is named after Miss Beverly Chilton in grateful acknowledgment of her discovery of the species and assistance in collecting a series at the type location.

ECOLOGY: The paratopotypes were taken along dusty dirt roads and paths in fields adjoining residential areas. The series of 53 specimens from near Saint Johns was collected at the base of a dune in sand blowouts, on the dunes and in surrounding flat areas of light colored, almost white, soil. Along the base of the dune the flies were running on the ground among four-wing salt-bush, *Atriplex canescens* (Pursh) Nuttall, plants and dead grass. Most specimens were found in open areas of light-colored soil, two females were sitting on dead mesquite, *Prosopis juliflora*, one male landed on an insect net and two others on the collector. All specimens

were taken between 9:00 and 11:30 A.M. The paratypes from 18 miles south of Gila Bend were collected in dry sandy areas adjacent to a dry sandy wash running among sparsely placed creosote-bushes, *Larrea tridentata*, and mesquite, *Prosopis juliflora*.

VARIABILITY: Among the 203 specimens a few exhibit some variability in several characters in both the males and females. In the males the frons may be tan pruinose, the vertex may be white or tan pruinose and brown pilose between the ocelli. The ground color of the antennae varies from having all three segments yellowish to all three being piceous. The compound eyes in four specimens are separated from the lateral ocelli on the vertex by only half the width of a lateral ocellus, a condition that appears to be due to a slight enlargement of the ocelli. The pronotal angles, the submargins and margins of the mesonotum and the scutellum may have scattered black macrochaetae. The dorso-caudal angles of the mesopleura in two specimens have one white macrochaeta mixed in the white pile. The tibiae of all legs may have a mixture of both black and white macrochaetae. The dark markings of abdominal segments two through four vary from being indistinct, due to the irregular pruinose mottling, to being distinct and separated dorsally from each other. The pile on the exterior of the terminalia is variable and may be either primarily white or dark and on the median projection of the ninth sternite it varies from all white to all black. On the interior of the terminalia the lower margin of the locking fold is usually angulate medially but may also be evenly convex with the widest portion anterior to the middle. The lateral apical upturned arms on the proctiger may touch or extend above the dorsomedian knob and when viewed from behind these arms resemble the handles on a loving cup, a character found only in this species (fig. 86). In a few specimens the lateral arms are obscured by membranous tissue from the median area and in one specimen the top of the median knob is expanded and has a shallow longitudinal median groove. The claspettes are strongly arched with the descending posterior portion extending beyond the posterior

vertical portion of the proctiger and the apex of the needle-like aedeagus. The ventral lobes of the claspettes end in an acute point, the inner margins of which are straight and angled inward and basally to about their middle. When the apices of the claspettes are together the angled straight edges of the ventral lobes form an inverted V into which the aedeagus would fit when extended. It is possible that they serve to guide or brace the aedeagus during coition. The terminalia structures are remarkably constant in the 123 specimens dissected.

In the female the dorsolateral markings on segments two through four may be indistinct or missing and the middorsal bare areas are sometimes irregular. Two specimens are entirely tan pruinose and in three specimens the piceous median stripe on the anterior and middle femora is lacking. The presence of the median stripe on the hind femora appears to be diagnostic for females of this species.

RELATIONSHIPS: *Apiocera chiltonae* appears to be most closely related to six other species with which it shares at least two characteristics, the arched claspettes and the ventrally extended bottom margin of the locking fold. From *fisheri* and *linsleyi linsleyi* it can be separated by its convex median projection of the ninth sternite and its lateral margins of the median projection which overlap the dististyles for almost their entire length. From *femoralis*, *rockefelleri*, *minckleyi*, and *franckei* it can be separated by its light reddish brown terminalia and by the handle-like arrangement of the lateral upturned arms of the proctiger (fig. 86).

Apiocera chiltonae (map 1) has been found to occur ecologically, geographically and chronologically together with *intonsa* (map 5) at 3.2 miles southeast of Saint Johns. Eventually it may also be found with *aldrichi* (map 9), which occurs in the Phoenix area but the latter species appears to prefer habitats near water, rivers and lakes, whereas *chiltonae* is found around dry dunes, sand blowouts and dusty dirt roads adjacent to residential areas. *Apiocera chiltonae* can be separated from *intonsa* by lacking the long recumbent pile on the median posterior projection of the ninth abdominal sternite and

by lacking the postmedian incisions in the inner dististyle margins. *Apiocera intonsa* has both of these features (see fig. 14). *Apiocera chiltonae* can be separated from *aldrichi* by its arcuate claspettes (fig. 64), by having the lateral extensions of the median projection of the ninth abdominal sternite overlapping the dististyles laterally for almost its entire length (see fig. 25), and by lacking the sickle-shaped blades on the proctiger (fig. 86). In *aldrichi* the claspettes are straight, the median projection of the ninth abdominal sternite does not overlap the dististyles laterally (fig. 16), and the apex of the proctiger has a pair of long, pointed, sickle-shaped blades (fig. 87).

37. *Apiocera linsleyi linsleyi*, new subspecies

Figures 26, 48, 85, 106; Map 10

DIAGNOSIS: Small-sized, narrow; pteropleura bare, gray pruinose in front of metathoracic spiracles; dististyles open ventrally from apex of median projection of ninth sternite to convergent subapical inner margins of dististyles (fig. 26); median projection of ninth sternite overlapping dististyles laterally for two-thirds its length, surface evenly rounded, gradually narrowed apically to blunt median point (fig. 26); opening between dististyles obscured by long, white pile; compound eyes separated from lateral ocelli on vertex by less than half the width of a lateral ocellus.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex gray pruinose, sparsely white and brown pilose between lateral ocelli; antennal segments one and two reddish brown, white pruinose, pilose and macrochaetose, segment three bare, reddish basally, brown to black pruinose apically, ending apically in short acute tooth; palpi white pruinose and pilose; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by less than half the width of a lateral ocellus. Thorax with pronotal angles light tannish pruinose, brown and white pilose, black and white macrochaetose; mesonotum light tan pruinose,

markings brown and gray pruinose, discal sparse short hairs brown, marginal and submarginal pile and macrochaetae mixed black and white; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle with sparse tuft of black and white hairs mixed, gray pruinose; wings with costal margin white pilose in basal two-thirds; scutellum gray pruinose, white pilose and macrochaetose; femora reddish brown, gray pruinose, white pilose and macrochaetose; tibiae light reddish brown, gray pruinose and white pilose, anterior and middle tibiae primarily white macrochaetose, hind tibiae brown and white pilose, black macrochaetose; anterior tarsi brown and white pilose, black macrochaetose, middle and hind tarsi brown pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen tan pruinose, black and brown maculose; segment one white pilose in basal half, mixed black and white pilose laterally, subapical margin with row of black macrochaetae, abundant laterally, middorsal area with depressed golden pruinose rounded spot extending from base to near apical margin; segments two through four with large dorsolateral irregular black spot not reaching margins (fig. 106), middorsal longitudinal golden pruinose wide lines extending from base to near apical margin; segment five with small dorsolateral brown spot and narrow middorsal line; segments six and seven without dorsolateral spots, middorsal line on segment six evident, lacking on segment seven; segments two through four with indistinct lateral longitudinal bands (fig. 106); segments two through seven sparsely brown pilose dorsally, white pilose laterally and ventrally. Terminalia: Exterior. Piceous; hemitergites sparsely brown pilose above, ventral margin and submargin long white pilose, ventral margin strongly emarginate behind acutely pointed apex; dististyles white pilose in apical three-quarters, sparsely brown pilose basally, outer and inner subapical margins evenly rounded to median blunt point, long white pile along lower margin extending over ventral opening between dististyles, inner margin without postmedian incision, open ventrally from apex of median projection of

ninth sternite to beginning of convergence toward apex; median projection of ninth sternite flattened, bare laterally, median inverted narrow V-shaped area bordered laterally with long white pile, lateral margins overlapping dististyles for almost their entire length, apical margins gradually converging medially to blunt apical point, margin and point turned inward. Terminalia: Interior. Hemitergites with sparse black pile along upper marginal area, six hairs on surface at base of locking fold, tuberculate area U-shaped extending along upper edge of locking fold, bending upward and posteriorly to upper margin with opening facing posteriorly, locking fold not strongly angulate from surface, semitransparent, lower margin broadly convex basally, shallowly emarginate toward apex, lower margin extending below ventral hemitergite margin, surface smooth, without tuft of pile; proctiger strongly constricted postmedially, gradually widened basally, abruptly widened laterally at middle, ventral extension projecting downward and anteriorly at about a 45-degree angle, dorsal projections separated medially by membrane, upper projections ending in short outcurved sharp points, lower posterior membranous portion surrounding the aedeagus (fig. 85); claspettes strongly arched from base to apex, concave internally, upper inner margins in median third membranous, subapical posterior margin with short rounded projection, subapical ventral lobes extending downward and anteriorly toward aedeagus, sparsely clothed with golden pile, lower basal margin of claspette sparsely golden pilose; interbasal fold acutely pointed posteriorly, point extending to lower dististyle margin, upper edge narrowly emarginate at top (fig. 48). Length 16 mm.; mesonotal width 4 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The upper front of head and vertex are tan pruinose, the lateral ocelli are bordered anteriorly with sparse black hairs. The mesonotum is tan and brown pruinose, marginal and submarginal macrochaetae primarily white, anterior tibiae primarily white macrochaetose, posterior tibiae white pilose, primarily black macrochaetose. Abdominal segments two

and three with dorsolateral elongate dark narrow bands not reaching borders of segments. Length 17.5 mm.; mesonotal width 4.5 mm.

TYPE MATERIAL: Holotype male, allotype female, 747 male paratopotypes, 21 female paratopotypes, three of which are teneral, collected at La Paz, Baja California Sur, Mexico, July 9–15, 24, 28, August 1–3, 1968 by J. Davidson, J. Bigelow, M. Bentzien, W. Fox, S. Williams and M. Cazier. Two hundred and thirty nine paratopotypes with the above data and N. Leppla added to the list of collectors. Thirteen paratopotypes were collected by S. Williams on July 6, 1968. One male paratype was collected in La Paz at the Guaycura Hotel, July 15, 1971, H. G. Real, R. E. Main. One male paratype was collected 2 miles south of La Paz, August 6, 1966 by J. A. Chemsak and one female paratype from the same location was collected on July 30, 1966 by J. A. and M. A. Chemsak and E. G. and J. M. Linsley.

Holotype male, allotype female and paratopotypes deposited in the collection of the American Museum of Natural History, New York. Paratopotypes and paratypes in the collection of Arizona State University, Tempe and the California Insect Survey collection, University of California, Berkeley. Paratopotypes and a paratype are in the California Academy of Sciences, San Francisco.

ETYMOLOGY: The species is named in honor of Dr. E. G. Linsley, Professor Emeritus, University of California, Berkeley, in grateful acknowledgment of his assistance and encouragement during this and other studies.

ECOLOGY: The 1020 paratopotypical specimens were collected along dusty dirt streets, paths and margins of old cultivated fields within the western and southern city limits of La Paz. One paratype was taken as it came into an ultraviolet light.

VARIABILITY: Considerable variability was found in some characteristics in the 1020 specimens comprising the type series. In seven specimens of males the lateral ocelli appear to be in contact with the inner margins of the compound eyes. The pronotal macrochaetae may be all white, all black or mixed, the marginal and submarginal meso-

notal macrochaetae vary from being all white to mixed black and white and the dorsal caudal angles of the mesopleura in three specimens has one white seta. In 12 specimens there were from one to three black macrochaetae on the upper subapical surface of the hind femora and in most specimens the hind tarsal pulvilli were slightly narrower and shorter than those of the front and middle tarsi. The marginal macrochaetae on the scutellum vary from all white to all black or a mixture of the two. The dorsolateral dark abdominal markings on segment five are often absent, or they may be narrowly connected dorsally with the median line on segments two and three. In a few specimens they are subtriangular, and those on segments two through four have the lower edge straight and the upper edge convex. In one specimen there is a small dark lateral spot on abdominal segment six and in two specimens there are bare lateral and middorsal areas on segments six and seven. In a few specimens the dorsal projections of the proctiger are straight vertically and may be close together or separated depending on the membrane that connects them and through which the aedeagus protrudes. In many specimens the posterior ventral point of the interbasal fold extends into the opening between the dististyles. The pruinosity on the abdomen, legs and occasionally the mesonotum is irregular causing a mottled appearance and three specimens are entirely gray pruinose. In the females the brown pile on the vertex of the head may extend downward beneath the median ocellus, the abdomen may have no maculations and the irregular pruinosity gives it a mottled appearance. The legs are often testaceous and the macrochaetae of the hind tibiae may be all black or mixed black and white. The number of digging spines on the terminalia varies from nine to 12.

In both males and females parts of all body segments and the femora and tibiae of the legs have, in addition to the pilose and pruinose covering, an irregular pollinose coating. This varies in thickness, in location, and in being attached or free from the surface. Pieces of this pollen-like material are scattered over the body and legs where they be-

come lodged among the hairs or macrochaetae. The coxae, tarsi, terminalia, antennae, and palpi do not appear to be involved. The internal structures of the terminalia show little or no variability in the 73 male specimens in which the hemitergites and dististyles were opened for study.

RELATIONSHIPS: *Apiocera linsleyi linsleyi* appears to be related to both *fisheri* and *chiltonae*. From *fisheri* it can be readily distinguished by its smaller size, its white macrochaetose hind femora, its primarily white macrochaetose anterior and middle femora and tibiae. In *fisheri* the femoral and tibial macrochaetae are primarily black or brown. In *linsleyi linsleyi* the inner interbasal fold has a small V-shaped notch in the median dorsal margin and the area posterior to the notch is gradually narrowed downward to a sharp point which extends into the space between the dististyles (fig. 48). In *fisheri* the inner interbasal fold has a large deep round median emargination in the dorsal margin and the area posterior to the nearly closed round emargination is broadly expanded and abruptly constricted downward to a sharp point which barely protrudes into the opening between the dististyles (fig. 47).

Apiocera linsleyi linsleyi can be separated from *chiltonae* by its dorsolateral spotted dark maculations on abdominal segments two through four (fig. 106) by its piceous and primarily white pilose terminalia, and by its unicolorous reddish brown legs. In *chiltonae* the abdominal dark maculations on segments two through four are transverse bands, the terminalia are reddish brown and primarily black or brown pilose, the legs are bicolorous with the femora piceous or black and the tibiae reddish brown. In *linsleyi linsleyi* the inner interbasal fold is as given above (fig. 48), whereas in *chiltonae* the dorsal margin has no notch in the median dorsal margin and the descending portion is wide with a bluntly rounded apex which protrudes into the space between the dististyles (fig. 49). In *linsleyi linsleyi* the upturned apex of the proctiger ends in two sharp spinelike vertical projections (fig. 85). In *chiltonae* the upturned apex is rounded and smooth and without apical vertical projections (fig. 86). Near the base

of the upturned rounded median portion there are two hornlike, sharp-pointed vertical projections that extend slightly outward and then back inward touching the median portion (fig. 86). Below the origin of these hornlike lateral projections there are two sharply pointed projections extending downward toward each side of the aedeagus (fig. 86).

Based on the material in hand, *linsleyi linsleyi* is one of the few polytypic species to be recognized in the genus *Apiocera*. A sample collected about 100 km. north of La Paz agrees with *linsleyi linsleyi* (map 10) in most basic structural characters but in my opinion, it is sufficiently different and distinguishable to merit recognition as a widely disjunct allopatric subspecies. Also, it was found under different ecological conditions. This subspecies, *linsleyi obliqua* (map 10), can be separated from *fisheri* and *chiltonae* as given in the discussion under *linsleyi linsleyi*. At present both *linsleyi linsleyi* and *linsleyi obliqua* are allopatric.

**38. *Apiocera linsleyi obliqua*,
new subspecies**
Figure 107; Map 10

DIAGNOSIS: Similar to *linsleyi linsleyi* with which it can be associated in the diagnosis of that species. In fundamental structural characteristics it belongs with *linsleyi linsleyi* but in distribution and a number of subordinate characters it is an easily recognizable allopatric geographical deviation.

MALE: Size range 15–19.5 mm.; average 18 mm.; in *linsleyi linsleyi* the size range is from 13–18 mm., average 16 mm. The mesonotal width at the widest part is 4.5 mm., whereas in *linsleyi linsleyi* it is 3.0 mm. The combined differences in these two morphological features result in the larger more robust appearance of *linsleyi obliqua*. The dorsum of the pronotum, mesonotum, and abdomen in *linsleyi linsleyi*, in all but a few specimens, is primarily tan pruinose, whereas in *linsleyi obliqua* it is primarily gray giving it a much lighter appearance. In all 117 specimens of *linsleyi obliqua* the dorsolateral dark markings on abdominal segments

two and three are strongly oblique with the narrow basal end projecting laterally (fig. 107). The upper or inner margins of the markings are convex whereas the lower margins are straight or concave (fig. 107). The subspecies is named after these characteristic features of the maculations which in *linsleyi linsleyi* are occasionally faintly indicated on segment two but not on segment three. In 109 specimens of *linsleyi obliqua* the lateral ocelli are strongly oblong along the linear body axis and larger than the median ocellus. In eight specimens the lateral ocelli are round or subovate and the same size as the median ocellus, a feature shared with *linsleyi linsleyi*. The internal terminalia structures are like those of *linsleyi linsleyi* and show little or no variability in the 19 male specimens in which the hemitergites and dististyles were opened for study.

FEMALE: The two specimens are indistinguishable from the females of *linsleyi linsleyi*. Both specimens have had their abdomens extended which gives them a much longer appearance, 20–24 mm.

TYPE MATERIAL: Holotype male, allotype female, 116 male paratopotypes, one female paratopotype collected at Santa Rita, Baja California Sur, Mexico, July 27, 1968 by J. Davidson, J. Bigelow, M. Bentzien, S. Williams and M. Cazier.

Holotype male, allotype female and paratopotypes deposited in the collection of the American Museum of Natural History, New York. Paratopotypes in the collection of Arizona State University, Tempe; and the California Insect Survey collection, University of California, Berkeley.

ETYMOLOGY: From the Latin *obliqua*, meaning oblique which is a characteristic feature of the dorsolateral dark markings on abdominal segments two and three.

ECOLOGY: The specimens were collected in an open flat, sand and gravel area sparsely covered with creosote bushes, *Larrea tridentata*, and a few mesquite trees, *Prosopis juliflora*. The flies were standing on sticks and stones on the ground in open areas. The habitat is quite different from that occupied by *linsleyi linsleyi* and the locality is about 100 km. northwest of the nearest record for

linsleyi linsleyi with no prominent topographical, edaphic or environmental barriers separating them (map 10).

RELATIONSHIPS: See discussion under *linsleyi linsleyi*.

39. *Apiocera clavator* Painter

Figures 17, 37; Map 8

Apiocera clavator Painter, 1936, pp. 196–197.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura bare; dististyles open ventrally from apex of median projection of ninth sternite to convergent tips of dististyles (fig. 17); lateral margins of median projection of ninth sternite not overlapping dististyles (fig. 17); median posterior projection of ninth sternite flat, without long recumbent pile (fig. 17); inner dististyle margins without postmedian incisions, curved sharply inward subapically (fig. 17). Terminalia: Interior. Claspettes not arcuate dorsoventrally.

FEMALE: Abdominal dorsolateral dark maculations longitudinal, elongate, oblong, usually narrow; dorsocaudal angle of mesopleura sparsely pilose and macrochaetose; posterior surface of posterior tibiae primarily or entirely black pilose; posterior femoral macrochaetae black; abdominal segments two and three without middorsal dark markings.

ECOLOGY: According to Lavigne (1975, pp. 674–675) the specimens of *clavator* "were collected on a stretch of sand along the edge of an unidentified stream. The dominant vegetation on the sandy area was *Mimosa pigra* Linnaeus, a mesquite type plant which grows in clumps and to a height of approximately 3.05 meters in this location. The majority of apiocerids were observed scurrying across the ground among the bases of low growing plants and grasses along both sides of an intermittent stream channel." For information on general behavior, courtship and mating, oviposition and predation refer to Lavigne (1975, pp. 675–676).

TYPE LOCALITY: Colima, Mexico, L. Conradt. Holotype male in the National Museum of Natural History, Washington, D.C., catalogue number 51437.



FIG. 7. Habitat *Apiocera infinita, aldrichi*. Palo Verde, Imperial County, California.

DISTRIBUTION: Mexico: Colima-Jalisco border: About one kilometer east of El Centinela. The turnoff (Camino Chavarin) to this town is about 16 kilometers north of Manzanillo, May 15, 1973, R. Lavigne (map 8).

RELATIONSHIPS: *Apiocera clavator* (map 8) does not appear to be closely related to any other known North American species because of its apically angulate dististyles (fig. 17), its deeply emarginate posterior hemitergite margin (fig. 37) and its elongate muscular attachment on the inner hemitergite surface (fig. 37). *Apiocera clavator*, according to available data, is allopatric but appears to be separated from *augur* by only a few kilometers along the Colima-Jalisco border (map 8).

40. *Apiocera aldrichi* Painter

Figures 6, 7, 16, 36, 87; Map 9

Apiocera aldrichi Painter, 1936, pp. 193–194.

DIAGNOSIS: Male: Large-sized, robust; pteropleura with long dense tuft of white hair

anterior to metathoracic spiracles; dorsocaudal angle of mesopleura with one to seven strong black macrochaetae in addition to pile; median projection of ninth sternite without long recumbent median pile, pile not projecting posteriorly beyond transverse projections of interbasal folds, margins not overlapping dististyles laterally (fig. 16); dark dorsal markings on abdominal segments three and four black and brown pilose, lateral margins of segments two through four white pilose; dorsal hemitergite margin with deep subapical emargination (fig. 36); dorsal posterior head surface white macrochaetose. Terminalia: Interior. Proctiger with an apical pair of horizontal dorsoventrally flattened, falciform, sharp-pointed blades protruding posteriorly from beneath dorsum of the lateral shields and above aedeagus (fig. 87); dististyles gradually and shallowly curved inward subapically, inner margins without postmedian incisions, margins not apposed ventrally from apex of median projection of ninth sternite to near apex (fig. 16); clas-

pettes not dorsoventrally arcuate, shallowly curved laterally; interbasal fold with single deep emargination in dorsal apical margin.

FEMALE: Large-sized, robust; pteropleura moderately densely clothed with long white pile; dorsocaudal angle of mesopleura with moderate to dense pile, sparsely white or black macrochaetose; costal wing vein entirely or predominantly black pilose; posterior tarsal pulvilli broad, about two-thirds as long as claws; dorsolateral dark maculations on abdominal segments two through four median and in the form of rounded spots.

TYPE LOCALITY: Yuma, Yuma County, Arizona, June 26, 1917, J. M. Aldrich. Holotype male in the National Museum of Natural History, Washington, D.C., catalogue number 51433.

DISTRIBUTION: Arizona: Maricopa County: Granite Reef, June 22, 1961, J. Strang; Granite Reef Dam, June 22, 1971, June 10, 1972, M. Everson, M. Kolner; Phoenix, June 24, 1941, July 17, 1932, F. H. Parker, H. Gentry; Verde River, May 14, 1974, S. Wincker; Tempe, June 11, 1969, J. Bigelow; 3.2 miles north northeast Saddleback Mountain, Lake Pleasant, May 29, 1974, M. Kolner, J. Alcock. Pinal County: 12 miles southwest Eloy, June 9, 1953, T. R. Haig; Florence, May 30, 1903, Philadelphia Academy of Sciences. Mojave County: Willow Beach, July 1, 1966, R. L. Westcott; 6 miles southeast Needles, June 9–14, 1976, J. Bigelow, Birduo; Burro Creek, May 10 and 16, 1970, W. L. Minckley, J. Coursen, J. Bigelow, M. Cazier. Yuma County: Yuma, June 18, 1970, Shadlp; Ehrenberg, June 23, 1978, W. B. Warner; 6 miles north Ehrenberg, June 22, 1978, W. B. Warner; Roll, May 28, 1946, S. E. McGregor; 6 and 7 miles south Parker, July 9, 1966, July 21, 1967, J. H. and J. M. Davidson, M. Cazier; 1 mile north Ligurta, July 27 and 30, 1967, J. M. Davidson, M. Cazier; Bill Williams Fort, F. H. Snow. California: Imperial County: Bard, June 22, 1968, R. L. Westcott, 8 miles east Holtville, June 22, 1963, R. L. Westcott; Haughtelin Lake, June 28, 1954, W. McDonald; Imperial Dam, June 28, 1954, W. McDonald; 5 miles west Westmoreland, June 4, 1970, L. (Welch) Draper, O. Francke, M. Cazier;

Palo Verde, July 11 and 26, 1966, 245 feet, J. M. Davidson, M. Cazier. Riverside County: Blythe, July 6 and May 17, 1947, June 24, 1945, J. W. MacSwain, May 15, 1939, F. H. Parker; 12 miles north Blythe, June 12, 1968, J. Doyer; 13 miles north Blythe, July 26, 1966, J. M. Davidson, M. Cazier; 20 miles west Blythe, April 20, 1939, F. H. Parker; 6 miles south Vidal, July 11, 1966, J. H. and J. M. Davidson, M. Cazier; 9 miles south Vidal, July 23, 1967, J. H. and J. M. Davidson, M. Cazier; 18 miles south Vidal, June 12, 1940, R. G. Dahl; Indio, June 16, 1941, J. Wilcox; Coachella, May 25, 1928, E. C. VanDyke. San Bernardino County: Southeast San Bernardino County, June 15, 1930, J. Wilcox. San Diego County: Anza-Borrego State Park, June 5, 1970, L. (Welch) Draper, O. Francke, M. Cazier. Nevada: Lincoln County: Desert Game Refuge, 30 miles north Las Vegas, July 29, 1949, F. B. Turner. Mexico: Sonora: 2 miles north El Doctor, June 6, 1968, N. Leppla, J. Bigelow, J. Davidson, M. Cazier; 5 miles south Riito, June 5, 1968, N. Leppla, J. Bigelow, J. Davidson, M. Cazier.

ECOLOGY: At Lake Pleasant a series of specimens was collected on rocks, leaves and branches in the shade of burro-brush, *Hymenoclea monogyra* Torrey and Gray, during the intense midafternoon heat. At Burro Creek the specimens were found sitting on smooth water-polished rocks and on small isolated sand bars that were formed behind seep-willow, *Baccharis glutinosa*, in a broad rocky stream bottom. In Tempe several specimens have been found drowned in swimming pools, probably falling in as they were attempting to drink. At Granite Reef Dam the flies were found on temporary sand accumulations below the dam and associated with mesquite trees, *Prosopis juliflora*, which they used for shade. At Ehrenberg they were collected along the shore of the Colorado River. At 13 miles north of Blythe a series was collected along a dirt road which was lined on both sides with quail-brush, *Atriplex lentiformis*, under which the flies were found in the shade. At 6 miles south of Parker a series was collected on relatively unconsolidated dunes in which there were

occasional large thickets of mesquite, *Prosopis juliflora*, and a few smaller plants which supplied shade for the flies (fig. 6). A large irrigation canal traversed the area along the southwest side supplying the flies with water. At 5 miles west of Westmoreland they were found along a dusty dirt road bordering a canal, 100 feet below sea level, which was lined with various grass species and arrowweed, *Pluchea sericea*. At Palo Verde specimens were taken in a sandy vacant lot on the south edge of town among quail-brush, *Atriplex lentiformis* (fig. 7) and on a dirt road leading to an open sandy area created by dredging operations on a man-made island in the Colorado River east of town that were surrounded by tamarisk shrubs, *Tamarix chinensis*. In the Borrego Badlands east of Borrego Springs seven specimens, several others were seen, were collected in the large semistabilized dune area surrounding the Borrego Springs garbage dump. The large dunes were partially stabilized by mesquite thickets, *Prosopis juliflora*, on their summits and the surrounding flat sandy areas were sparsely covered with creosote-bush, *Larrea tridentata*, and bur-sage, *Franseria* species. No natural water source was found in the vicinity and no flies could be attracted by an artificial supply. However, the single specimen was found flying around and landing on the white enameled surface of a motor home. At 2 miles north of El Doctor the flies were found on sand hills surrounding small standing pools of water. The dunes were sparsely covered with salt-brush, *Atriplex* species; *Croton* species; and bur-sage, *Franseria* species, which were being used for shade by the flies. Several specimens were seen flying around a bronze colored power-wagon truck and a number were collected as they landed on the hot surface of the hood and top. At 5 miles south of Riito the same habitat conditions and behavior were present except that the sparse vegetation cover consisted of creosote-bush, *Larrea tridentata*; mesquite, *Prosopis juliflora*; bur-sage, *Franseria* species; and joint-fir, *Ephedra* species.

RELATIONSHIPS: Based on the falciform blades that protrude posteriorly from below the apex of the proctiger (fig. 87), *aldrichi* is

most closely related to *arnaudi*, *beameri*, and *hispida*, the only other species with this structure. All four species are allopatric (map 9) and can be separated from each other as shown in the key.

Apiocera aldrichi (map 9) has been found to occur ecologically, geographically and chronologically together with several other distantly related species. At 5 miles south of Riito both *caloris* (map 10) and *sonorae* (map 6) were found at the same time and in the same microhabitat with *aldrichi* and were behaving in much the same manner. At Blythe *aldrichi* was found in close association with *caloris* (map 10), *infinita* (map 5), *parkeri* (map 11), and *pearcei* (map 10). At 20 miles west of Blythe *aldrichi* was found intermixed with *parkeri* (map 11) and at 6 miles southeast of Needles it was found in the same microhabitat with *infinita* (map 5) and *pearcei* (map 10). At 6 miles south of Parker *aldrichi* was found with *intonsa* (map 5), whereas at 7 miles south of Parker it was co-inhabiting with *infinita*. At Bard, Palo Verde, Haughtelin Lake, Ehrenberg and 7 miles south of Parker, *aldrichi* was closely associated ecologically with *infinita*. At 18 miles south of Vidal *aldrichi* was taken with *intonsa*, at 2 miles north of El Doctor with *spectabilis* (map 10) and at 1 mile north of Ligurta with *infinita*. *Apiocera aldrichi*, *interrupta* (map 6) and *trimaculata* (map 13) have all been taken at different times at Indio by different collectors.

All nine species that occur in varying associations, as listed above, can be distinguished from *aldrichi* as given in the key and by the single character in the terminalia. They all lack the falciform horizontal posterior blades on the proctiger (fig. 87). As mentioned earlier this structure is present only in *aldrichi*, *arnaudi*, *beameri*, and *hispida*. Of these four species *aldrichi* appears to be most closely related to *arnaudi*, but can be separated by the key characters, by its dark brown mesonotal pruinosity and more numerous black hairs on the vertex and frons of the head. The male terminalia, both internally and externally, are practically identical except as indicated under *arnaudi*.

41. *Apiocera arnaudi*, new species

Map 9

DIAGNOSIS: Medium-sized, robust; pteropleura with dense tuft of long white hair; dorsocaudal angle of mesopleura densely clothed with long brown hair, four to five long black macrochaetae intermixed; median projection of ninth sternite not extending posteriorly to transverse portions of interbasal folds, not overlapping dististyles laterally; dark dorsal markings on abdominal segments three and four black or brown pilose; hemitergites of terminalia with shallow subapical notch on inner margin; lateral margins of abdominal segments two to four primarily brown pilose; costal wing vein black pilose throughout; terminalia brown pruinose.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex gray pruinose, brown pilose between, behind and in front of ocelli, hairs long; antennal segments one and two dark, white pruinose and pilose, segment one white macrochaetose, segment two black and white macrochaetose, segment three bitextured, reddish basally, black apically, ending in short acute tooth; palpi yellowish, white pruinose and pilose; posterior head surface white pruinose and pilose, black and white macrochaetose; compound eyes separated from lateral ocelli on vertex by more than half but less than the width of a lateral ocellus. Thorax with pronotal angles gray pruinose, brown pilose, black macrochaetose; mesonotum dark, markings faint, gray pruinose markings on anterior border, discal surface light and dark brown pruinose, pile moderately long brown and dense, marginal and submarginal pile long and brown, macrochaetae black; mesopleura grayish tan pruinose, white and brown pilose, dorsocaudal angle with dense tuft of long brown hair, macrochaetae black and white mixed; wings with costal margin black pilose from base to near apex; scutellum black, brown pruinose medially, pile long and black, marginal lateral macrochaetae black, pile beneath marginal macrochaetae long and white. Legs with coxae gray pruinose, white pilose, black macrochaetose; anterior and middle femora black, gray pruinose, black and white pilose,

black macrochaetose, hind femora black, brown pilose, black macrochaetose; tibiae reddish brown, pile brown, macrochaetae black; tarsi light reddish brown, pile brown, macrochaetae black; tarsal pulvilli broad, three-quarters as long as claws. Abdomen with segment one dark, white pilose, subapical margin with lateral row of black macrochaetae; segments two through four black dorsally except for narrow apical border, pile long dense and brown, dorsal markings separated from wide longitudinal markings along pleural suture by narrow gray pruinose longitudinal band, ventral surface white pilose and pruinose; segment five white pruinose and pilose except for narrow dark longitudinal band extending along pleural suture from base to apical one-quarter; segment six entirely white pruinose and pilose; segment seven white pruinose, black or brown and white pilose. Terminalia: Exterior. Dark brown, pile black; hemitergites sparsely black pilose, ventral margin convex, broadly rounded from base to apex, dorsal or inner margin shallowly notched subapically, narrowing to point at juncture with internal locking fold, ventral margin bent subapically at this juncture; dististyles short black pilose above, long black pilose beneath and along inner margin, open ventrally from near base of median projection of ninth sternite to converging tips near apex, inner margin without postmedian incision; median projection of ninth sternite narrow, flattened, black pilose medially, lateral margins subparallel in basal half, gradually narrowing to apical median point, not overlapping dististyles laterally. Terminalia: Interior. Hemitergites sparsely black pilose subapically above base of locking fold, six short black hairs in a line near inner edge at base of locking fold, tuberculate area large, extending from inner base of locking fold almost to dorsal margin, sparsely tuberculate toward apex, lower margin of locking fold emarginate near middle, abruptly angled basally, descending to surface, not extending below ventral margin of hemitergite; proctiger wide at base, gradually narrowing to middle constriction, narrowly constricted to postmedian wide lateral shieldlike expan-

sions, extending dorsally at right-angles to proctiger to acute right-angled corners, projecting downward and forward at a 45-degree angle, shield margins straight and subparallel in upper half, abruptly expanded laterally at middle, gradually rounded downward beneath aedeagus, middle of lateral expansion with prominent posteriorly oriented short spine, posteriorly and below upper edge of shield, about on a level with the spines, are two flattened sickle-shaped posterior projections arranged like forceps, closed at tips, above the aedeagus and not supporting it and not bent ventrally; claspettes straight, widened at base and apex, inner surface concave, sparsely golden pilose, upper margins not membranous, apical one-quarter broad, ending in blunt evenly rounded projection with ventral tuft of short golden pile, apical enlargement forming base of subapical ventral lobes, lobes long, concave on inner surface, extending downward and inward to aedeagus, gradually narrowed from base to bluntly rounded apex, densely clothed with both golden and black pile; interbasal folds bilobed, outer lobe narrowly extending into ventral opening between dististyles, closely attached to inner lobe, inner lobe broadly open apically, inner surface smooth, sparsely golden pilose, tooth forming inner and basal margin of apical groove densely golden pilose on inner basal edge, apex of tooth sparsely golden pilose. Length 23 mm.; mesonotal width 6 mm.

FEMALE: Unknown.

TYPE MATERIAL: Holotype male collected in the Sierra Pedro Martir Mountains; 2 miles east of Socorro, 5000 feet, Baja California Norte, Mexico, June 4, 1958 by J. Powell. One male paratype collected 5 miles east of Rancho El Coyote, 3600 feet, Sierra San Pedro Martir Mountains, Baja California Norte, Mexico, June 1, 1974 by R. L. Westcott.

Holotype male deposited in the collection of the California Academy of Sciences, San Francisco. Paratype male to be deposited in the collection of Eric M. Fisher, but at present on loan in the author's collection.

ETYMOLOGY: The species is gratefully named in honor of Dr. Paul Arnaud, Jr., Cal-

ifornia Academy of Sciences, San Francisco, who generously loaned material from the collections in his charge.

ECOLOGY: No information available.

RELATIONSHIPS: *Apiocera arnaudi* (map 9) can be separated from *parkeri* by its larger size, the spine on the proctigeal shield, its flattened horizontal sickle-shaped apical proctigeal extensions (see fig. 87), its black coxal macrochaetae, and black femora. From *aldrichi* with which it is similar in size, *arnaudi* can be distinguished by the acute dorsolateral angles of the proctigeal shield, by the dark dorsal pile on abdominal segment two, and by its black coxal macrochaetae. From *powelli* Cazier with which it is narrowly allopatric (map 13), it can be separated by the lateral spine on the proctigeal shield, the acute dorsolateral angles of the proctigeal shield, by its flattened horizontal sickle-shaped apical proctigeal extensions which do not extend downward on each side of the aedeagus (see fig. 87), and by the wide, deep apical groove on the inner lobe of the interbasal fold. In *powelli* there is no lateral spine on the proctigeal shield (fig. 88) and the dorsolateral margins are gradually convergent, not angulate. *Apiocera powelli* lacks the sickle-shaped apical proctigeal extensions, but has two rounded posterior extensions, with slightly divergent tips, that extend downward on each side of the aedeagus (fig. 88). In *powelli* the apex of the inner interbasal fold lacks the deep emargination but is shallowly turned inward.

42. *Apiocera hispida* Cazier

Figures 50, 114; Map 9

Apiocera hispida Cazier, 1941, pp. 605-606.

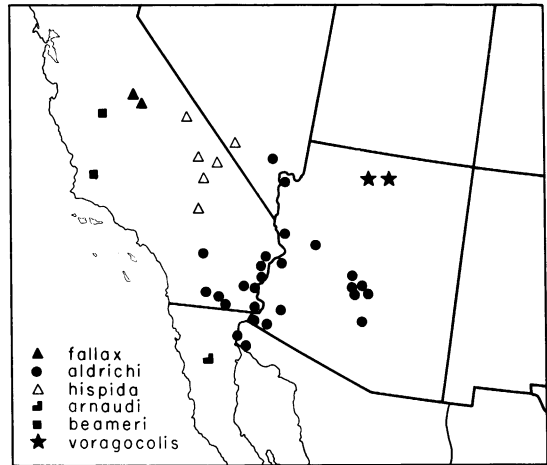
DIAGNOSIS: Male: Large-sized, robust; pteropleura with moderate to dense long white hair anterior to the metathoracic spiracles; dorsocaudal angle of mesopleura with one or more white or black macrochaetae and moderately dense white pile; median projection of ninth sternite not extending posteriorly to apical third of dististyles or posteriorly beyond transverse portions of interbasal folds, lateral margins rounded, not overlapping dististyles laterally; dark dorsal

markings on abdominal segments three and four primarily or entirely white pilose, dark basal abdominal markings on segments two and three not reaching apical margin medially (fig. 114); compound eyes separated from the lateral ocelli on vertex by more than the width of a lateral ocellus (fig. 50). Terminalia: Interior. Proctiger with an apical pair of horizontal, dorsoventrally flattened, falciform, apposing, sharp-pointed blades protruding posteriorly from beneath dorsum of lateral shield and above aedeagus; dististyles gradually and shallowly curved inward subapically; claspettes not arcuate dorsoventrally, slightly arcuate laterally; interbasal folds with single deep emargination in dorsal apical margin.

FEMALE: Large-sized, robust; pteropleura moderately densely clothed with long white pile; dorsocaudal angle of mesopleura moderately densely white pilose, sparsely white macrochaetose; abdominal segment one with lateral submarginal macrochaetae black; costal wing vein either predominantly white or black pilose; posterior tarsal pulvilli more than half as long as claws; abdominal dorsolateral dark maculations in the form of spots of varying sizes.

TYPE LOCALITY: Yermo, San Bernardino County, California, May 23, 1940, W. Reeves, P. C. Ting, M. Cazier. Holotype male in the American Museum of Natural History, New York.

DISTRIBUTION: California: San Bernardino County: 2 miles south of Cronise Lake, June 10, 1940, W. F. Barr; Cronise Lake, May 20, 1978, James O'Grady; Saratoga Springs, Death Valley National Monument, June 16–19, 1954 and May 27–29, 1955, J. Belkin, McDonald. Inyo County: Shoshone, June 17, 1954, J. Belkin, McDonald; Bennetts Well, Death Valley National Monument, April 24, 1955 and April 15, 1968, J. Bigelow, M. Cazier; Midway Well, Death Valley National Monument, April 24, 1964, A. R. Gittins and April 11, 1968, J. Bigelow, M. Cazier; Warm Springs, May 8, 1958, R. M. Bohart; Warm Sulphur Springs, May 6, 1961, P. M. Marsh. Nevada: Nye County: Big Spring, Ash Meadows, May 31, 1955, J. Belkin.



MAP 9. Distributions of *Apiocera* sp.: *A. fallax*, *aldrichi*, *hispida*, *arnaudi*, *beameri*, *voragocolis*.

ECOLOGY: At Saratoga Springs the flies were found on the semiconsolidated dunes adjacent to a small lake and were primarily in the shade of quail-brush, *Atriplex hymenelytra* (Torrey) Watson, tamarisk trees, *Tamarix chinensis*, and bur-sage, *Franseria dumosa* Gray. At Bennetts Well they were collected as they came in to drink on moist sandy spots at a well pump in a small dune area adjacent to an extensive stand of tamarisk trees, *T. chinensis*. At Midway Well a series was obtained by splashing and running water onto the sand from a well pump that was next to a large mesquite thicket, *Prosopis juliflora*, under which loose sand had accumulated. The flies came out of the shade of the thicket to drink on the moist sand.

RELATIONSHIPS: As indicated in the discussion of *aldrichi*, *hispida* is one of four species, including *arnaudi*, *beameri*, and *aldrichi*, that can be separated from all other species by the proctigeal structure as given in the key (see fig. 87). It appears to be most closely related to *beameri* but can be separated by the shape of its abdominal markings (fig. 114), the position of its compound eyes, as given in the key (fig. 50), and by its distribution (map 9). Geographically it occurs about midway between the ranges of *bea-*

meri (map 9) and *aldrichi* (map 9), but they are allopatric so far as known.

Apiocera hispida (map 9) has been found to occur both geographically and chronologically together with *arena* (map 11) in two locations, 2 miles south of Cronise Lake and at Yermo, which is the type locality of *hispida*. The two species are only distantly related. *Apiocera hispida* has the falciform horizontal posterior blades on the proctiger (see fig. 87) but lacks the subapical dorsoventral aedeagal guides on this structure, the median projection of the ninth abdominal sternite is not widely expanded laterally, its margins are evenly rounded and it does not overlap the dististyles laterally, it is larger and more robust. *Apiocera arena* lacks the falciform horizontal posterior blades on the proctiger but has two subapical dorsoventral projections which extend downward on each side of the aedeagus (fig. 90), the median projection of the ninth abdominal sternite is moderately expanded laterally, the margins are subparallel and narrowly overlap the dististyles laterally; it is smaller and narrower than *hispida*.

43. *Apiocera beameri* Painter

Figures 51, 113; Map 9

Apiocera beameri Painter, 1936, pp. 198–199.

DIAGNOSIS: Male: Large-sized, robust; pteropleura with dense long white pile anterior to metathoracic spiracles; dorsocaudal angle of mesopleura with one or more heavy black or white macrochaetae in addition to hair; median projection of ninth sternite not extending posteriorly to apical third of dististyles or posteriorly beyond transverse portions of interbasal folds, lateral margins rounded, not overlapping dististyles laterally; dark dorsal markings on abdominal segments three and four primarily or entirely white pilose, dark basal transverse vittae on segments two and three narrowly reaching apical margin medially (fig. 113); compound eyes separated from lateral ocelli on vertex by less than the width of a lateral ocellus (fig. 51). Terminalia: Interior. Proctiger with an apical pair of horizontal, dorsoventrally flattened, falciform, apposing, sharp-pointed

blades protruding posteriorly from beneath dorsum of lateral shield and above aedeagus; dististyles gradually and shallowly turned inward subapically; claspettes not arcuate dorsoventrally; interbasal folds with single deep emargination in dorsal apical margin.

FEMALE: Large-sized, robust; abdominal dorsolateral dark maculations elongate, oblong, usually narrow; dorsocaudal angle of mesopleura with disc bare or with a few hairs along ventral margin; costal wing vein entirely or primarily black pilose; dorsal posterior head surface and cervix white macrochaetose.

TYPE LOCALITY: Cuyama Ranch, Santa Barbara County, California, July 25, 1935, R. H. Beamer. Holotype male, allotype female in the Snow Collection at the University of Kansas, Lawrence.

DISTRIBUTION: California: Santa Barbara County: New Cuyama, July 24, 1976, James O'Grady. Fresno County: 8 miles west Kerman, August 2, 1960, Roy Snelling; Firebaugh, July, 1974, Larry Bezark.

ECOLOGY: Unknown.

RELATIONSHIPS: For many years I could find no specimens that matched one character that Painter (1936, p. 199) used to distinguish this species. He stated "Abdomen white pollenose; bare, black spots on the dorsum forming a pattern similar to that of *haruspex*"; the confusion was in the bare black abdominal spots. Through the courtesy of James O'Grady it has been possible to study four male specimens that were collected at New Cuyama, which is only a few miles west of the type locality. They agree closely with the characters given by Painter, except that the black spots on the abdominal markings are clothed with long white pile. However, the markings, especially on segments two and three, are shiny black because they lack pruinosity (=pollenose) which is evidently what Painter was referring to. In two of the specimens the dark markings on segment four are sparsely and irregularly golden pruinose.

As indicated in the discussion of *aldrichi*, *beameri* is one of four species, including *aldrichi*, *arnaudi*, and *hispida*, that can be separated from all other species by the procti-

geal structure as given in the key (fig. 87). Of the other three, *beameri* appears to be most closely related to *hispidi*, but can be separated from it by the abdominal maculations (fig. 113) and by having the compound eyes separated from the lateral ocelli on the vertex by less than the width of a lateral ocellus (fig. 51). The two species are allopatric, *beameri* (map 9) occurring in the San Joaquin Valley and west of the Sierra Nevada and Tehachapi Mountains, whereas, *hispidi* (map 9) is found in the Mohave Desert east of the Sierra Nevada and Tehachapi Mountains.

Apiocera beameri (map 9) has been found to occur geographically, ecologically and chronologically together with *barri* (map 2) at New Cuyama, but the two are only distantly related. *Apiocera beameri*, in addition to having the falciform horizontal posterior blades on the proctiger (see fig. 87), lacks the long recumbent pile on the ninth abdominal sternite, the inner dististyle margins lack the postmedian incisions and the margins are not apposed in the apical third, the inner interbasal folds have a single apical emargination and the ventral subapical lobes on the claspettes are long and sinuous and with the base thickened. In *barri* there are no falciform horizontal posterior blades on the proctiger (see fig. 87), the ninth abdominal sternite has long recumbent hair extending from the base of the median projection posteriorly to the deep transverse incisions in the inner dististyle margins which are apposed in the apical third, the inner interbasal folds are biemarginate apically and subapically, the ventral subapical lobes on the claspettes are short, straight, and without the thickened base (fig. 55). There are many other differences.

44. *Apiocera powelli*, new species

Figures 20, 88; Map 13

DIAGNOSIS: Medium-sized, narrow; pteropleura with moderately dense tuft of long white hair in front of metathoracic spiracles; dorsocaudal angle of mesopleura with one or two strong black macrochaetae in addition to dense patch of long brown hair; median projection of ninth sternite not extending pos-

teriorly to transverse portions of interbasal folds (fig. 20), overlapping dististyles laterally from middle to apical angles when closed; hind tibiae black macrochaetose; compound eyes separated from lateral ocelli on vertex by more than one-half the width of a lateral ocellus; terminalia piceous, without evident pruinosity; abdominal segment four white, without dark dorsal markings; median projection of ninth sternite with posterior margin deeply emarginate on both sides of median projection (fig. 20).

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex gray pruinose, brown pilose between, in front of and behind ocelli; antennal segments black, segments one and two white pruinose, pilose and macrochaetose, segment three bare, bicolored dark pruinose, ending apically in short acute tooth; palpi white pruinose and pilose; posterior head surface white pruinose and pilose, macrochaetae black and white mixed; compound eyes separated from lateral ocelli on vertex by more than half the width and less than the width of a lateral ocellus. Thorax with pronotal angles black, gray pruinose, black pilose and macrochaetose; mesonotum black, dark gray and brown pruinose, maculations obscure, discal short hairs brown, marginal and submarginal pile and macrochaetae brown or black; mesopleura black sparsely gray pruinose, brown and white pilose, dorsocaudal angle with prominent brown pile, macrochaetae black; wings with costal margin black pilose from base to near apex; scutellum black, brown pilose, marginal macrochaetae black. Legs with coxae black, gray pruinose, white pilose, black macrochaetose; femora black, anterior and middle black and white pilose, black macrochaetose, posterior black pilose and macrochaetose; tibiae piceous, anterior and middle brown and white pilose, black macrochaetose, posterior brown pilose, black macrochaetose; tarsi reddish brown, brown pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen black and white, segment one black, brown pruinose basally and medially, dorsal pile primarily brown, lateral hair tufts dense, mixed black and white, subapical

margin with row of black macrochaetae, abundant laterally; segment two black, narrow brown pruinose basal band, dorsolateral apical margin with small rounded white pruinose spot on each side extending laterally to pleural margin, pile long, brown dorsally, sparsely white laterally; segment three entirely black, pile black or brown; segments four through seven white pruinose and pilose, segment four with lateral elongate narrow band extending from basal margin to apical third along pleural suture; ventral pile on segments two and three long, black and white mixed, on segments four through seven white. Terminalia: Exterior. Reddish brown; hemitergites sparsely black pilose, ventral margin strongly emarginate behind acutely pointed apex; dististyles black pilose, open ventrally from apex of median projection of ninth sternite to beginning of convergence at apex, inner margin without postmedian incision (fig. 20); median projection of ninth sternite flattened, black pilose medially and laterally, median pile more dense, lateral margins overlapping dististyles narrowly in apical third, open basally, lateral margins strongly angulate outward to bluntly rounded lateral apical projections, posterior margin deeply emarginate between lateral projections and prominent median acute point, not curved inward, posterior margin W-shaped (fig. 20). Terminalia: Interior. Hemitergites sparsely black pilose apically and subapically, base of locking fold with few short hairs in short row, tuberculate area large, in upper half above locking fold, tubercles more dense basally, locking fold margin bilobed, surface smooth, semitransparent, lower bilobed margin projecting below ventral margin of hemitergite; proctiger wide at base, gradually widening to middle, narrowly constricted postmedially to wide lateral shieldlike expansions projecting downward and anteriorly at a 45-degree angle, both sides forming a heart-shaped semitransparent subapical shield, posterior subdorsal portion of shield with strong parallel lateral arms extending posteriorly, tips abruptly bent downward at a 45-degree angle, points acute, extending downward on each side of

aedeagus (fig. 88); claspettes straight, widened at base and apex, inner surface concave, upper margins not membranous, sparsely short golden pilose, apical third broad, ending in blunt apical projection, ventral surface forming wide concave base of subapical ventral lobes, ventral lobes extending downward and inward to aedeagus, gradually narrowing from base to bluntly rounded apex, sparsely clothed with long golden pile; interbasal folds bilobed apically, lower lobe narrow and bluntly pointed apically, narrowly divided from upper inner lobe, upper lobe broad at base, subapically curved slightly inward, apex with a half circle inward curve for width of lobe, upper margin sparsely golden pilose, interbasal folds barely projecting into opening between dististyles. Length 20 mm.; mesonotal width 4.5 mm.

FEMALE: Unknown.

TYPE MATERIAL: Holotype male collected in the Sierra San Pedro Martir Mountains, 2 miles west Socorro, 3000 feet, Baja California Norte, Mexico, June 4, 1958 by J. Powell.

Holotype male deposited in the collection of the California Academy of Sciences, San Francisco.

ETYMOLOGY: The species is gratefully named after Dr. Jerry Powell in appreciation for the *Apiocera* material he collected and made available.

ECOLOGY: No information available.

RELATIONSHIPS: *Apiocera powelli* (map 13) can be distinguished from all other North American species by having no black or dark maculations on the dorsum of abdominal segment four and by its unusual median projection of the ninth abdominal sternite. This structure is broadly expanded posteriorly from a narrow base and the posterior margin is tridentate due to the deep emarginations on each side of the median projection (fig. 20). From its nearest geographical relative, *arnaudi* (map 9), taken 2 miles east of Socorro but at 5000 feet elevation, it can be separated by the above characteristics, by its smaller size, narrower shape and other characters as given in the discussion of *arnaudi*.

45. *Apiocera alleni* Cazier

Figure 23; Map 12

Apiocera alleni Cazier, 1941, pp. 606–607.

DIAGNOSIS: Male: Large-sized, robust; pteropleura with dense long white hair anterior to metathoracic spiracles; dorsocaudal angle of mesopleura with one or more strong black macrochaetae in addition to hair; median projection of ninth sternite extending posteriorly to apical third of dististyles, beyond apex of transverse portions of interbasal folds, densely clothed with medium-long black hair especially laterally (fig. 23); terminalia piceous, without white pruinosity; abdominal segment four with dorsal dark markings. Terminalia: Interior. Proctiger without falciform horizontal posterior blades; dististyles gradually curved inward subapically (fig. 23); claspettes not arcuate dorso-ventrally.

FEMALE: Unknown.

TYPE LOCALITY: Desert east of Victorville, San Bernardino County, California, June 27, 1932, R. P. Allen. Holotype male in the collection of the American Museum of Natural History, New York.

DISTRIBUTION: California: San Bernardino County: Joshua Tree National Monument, 6 miles northwest Hidden Valley, June 8, 1965, Joe Wilcox; Baker, May 27, 1978, James O'Grady. San Diego County: Palm Grove, Palm Canyon, Anza-Borego State Park, June 5, 1970, L. (Welch) Draper, O. Francke, M. Cazier.

ECOLOGY: In the palm grove the specimens were collected at the upper end of the grove as they came in presumably to drink. Above a small waterfall, where they were most abundant, they came in to wet black or gray ashes from a previous fire. Below the waterfall they were on the damp soil next to the small stream.

RELATIONSHIPS: *Apiocera alleni* differs from all other species by having the median projection of the ninth abdominal sternite narrow and extending posteriorly to or beyond the apical margin of the interbasal folds which extend prominently into the ventral opening between the dististyles (fig. 23). In

the basal half the margins of the projection are densely clothed with medium length black hair that extends outward and backward at about a 45-degree angle. In the apical half there are dorsal as well as lateral black hairs on the projection (fig. 23).

At Palm Grove *alleni* (map 12) occurs geographically, ecologically and chronologically together with *spectabilis* (map 10), *volucra* (map 3), and *pearcei* (map 10) all of which strongly resemble *alleni*, especially in the abdominal maculation pattern. However, in addition to the above character, *alleni* as well as *spectabilis* and *pearcei* can be separated from *volucra* by lacking the long recumbent pile on the median projection of the ninth abdominal sternite and the transverse postmedian incision in the inner dististyle margin, by having the inner dististyle margins separated in the apical third, and by having the ventral subapical lobes on the claspettes long and sinuous. *Apiocera volucra* has moderately dense recumbent black hairs extending from the base of the median projection posteriorly to the narrow postmedian incision in the inner dististyle margins which are apposed in the apical third, and the ventral subapical lobes on the claspettes are short and straight. *Apiocera alleni* has a long collar separating the apex from the lateral projections on the proctiger. In *spectabilis* and *pearcei* the collar is short to medium, respectively. In *alleni* the lateral extensions of the median projection of the ninth abdominal sternite are tumid, obscured by pile, and do not overlap the dististyles laterally (fig. 23). In *pearcei* and *spectabilis* (fig. 13) the lateral extensions are flat, parchment-like and overlap the dististyles laterally.

46. *Apiocera caboae*, new species

Figure 96; Map 10

DIAGNOSIS: Medium-sized, narrow; pteropleura bare, light tan pruinose anterior to metathoracic spiracles; median projection of ninth abdominal sternite without long recumbent pile; inner dististyle margins without postmedian incisions, margins not apposed ventrally from apex of median projection of

ninth sternite to near apex; claspettes not arcuate dorsoventrally; median projection of ninth sternite not biemarginate apically, shallowly curved inward laterally, overlapping dististyles only at widest part, not elongate; dististyles gradually curved inward subapically; proctiger broad dorsally, without sickle-shaped horizontal posterior blades (fig. 96); abdominal segment four with dorsal dark markings; compound eyes separated from lateral ocelli on vertex by less than half the width of a lateral ocellus; costal wing vein white pilose.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex gray pruinose, white pilose; antennal segments one and two testaceous, white pruinose and pilose, segment three (missing on right side) testaceous basally, dark apically, ending in short acute tooth; palpi white pruinose and pilose; posterior head surface golden pruinose dorsomedially, white pruinose otherwise, white pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by less than half the width of a lateral ocellus. Thorax with pronotal angles light tannish pruinose, white pilose and macrochaetose; mesonotum tan pruinose, markings brown, disc sparsely brown pilose, margins white pilose and macrochaetose; mesopleura white pruinose and pilose; dorsocaudal angle white pruinose, pilose and macrochaetose; costal wing vein white pilose from base to near apex; scutellum gray pruinose, white pilose, marginal macrochaetae black. Legs testaceous, coxae white pruinose, pilose and macrochaetose; anterior and middle femora white pruinose, primarily white pilose and macrochaetose; anterior and middle tibiae with mixed white and black pile and macrochaetae, posterior tibiae white pruinose, black pilose and macrochaetose; tarsi black pilose and macrochaetose, tarsal pulvilli moderately broad, two-thirds as long as claws. Abdomen tan pruinose, brown maculose; segment one white pruinose and pilose, subapical marginal macrochaetae mixed black and white; segments two through four with narrow elongate middorsal, dorsolateral and pleural brown linear markings, segment two white pilose, seg-

ments three and four brown and white pilose dorsally, white pilose laterally; segments five through seven with dorsolateral and pleural narrow linear brown markings, surface of segments white pruinose and pilose; segments one through eight white pruinose and pilose ventrally. Terminalia: Exterior. Testaceous; hemitergites sparsely brown pilose in dorsal three-quarters, white pilose and tan pruinose along ventral one-quarter, dorsal margin shallowly angulate downward at about apical third, apex prominent, bluntly rounded, ventral margin evenly shallowly rounded from base of apex anteriorly to base; dististyles gradually narrowed from base to bluntly rounded apex, primarily white pilose, tan pruinose, inner margins without postmedian incision, open ventrally from median projection of ninth sternite to near apex; median projection of ninth sternite flattened, lateral membranous expansions with margins evenly rounded from base to blunt short median posterior projection, overlapping dististyles laterally only at widest point, margins turned slightly inward, surface sparsely black and white pilose medially, bare laterally. Terminalia: Interior. Hemitergites with sparse black pile along dorsal margin, more numerous along apical one-third, elongate tuberculate area in upper third anterior to angulation in dorsal margin, locking fold angulate from surface at about 45 degrees, ventral margin with single shallow undulation, not extending to ventral hemitergite margin, without pile; proctiger wide and flattened dorsally, margins slightly divergent basally into membranous area, margins parallel medially, converging abruptly to posterior junction with lateral shield margins (fig. 96), lateral shield with margins diverging downward and outward at a 45-degree angle anteriorly, apex with dorsomedian inverted V-shaped notch, outer margins extending downward on each side of aedeagus; claspettes straight narrow, sparsely pilose, narrowly convergent from base to apex, subapical lobes moderately long, thickened in basal half, thin apically, sparsely pilose, extending downward and inward beneath aedeagus; inner interbasal fold with elongate apical emargination in dorsal mar-

gin, apex shallowly curled inward, bluntly rounded, not extending ventrally into opening between dististyles. Length 16.6 mm.; mesonotal width 3.5 mm.

FEMALE: Unknown.

TYPE MATERIAL: Holotype male collected at San Jose del Cabo, Baja California Sur, Mexico, July 17, 1971 by H. G. Real and R. W. Main. Holotype male in the collection of the California Academy of Sciences, San Francisco.

ETYMOLOGY: The species is named after the type location San Jose del Cabo on the southernmost tip of Baja California, Mexico.

ECOLOGY AND VARIABILITY: No information available.

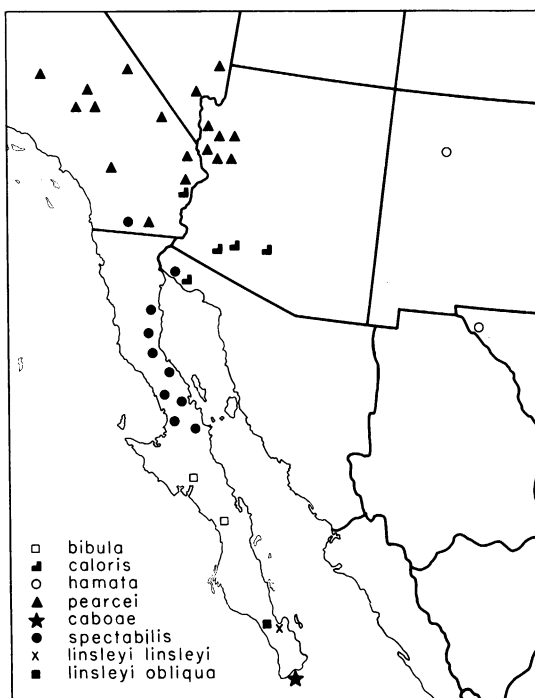
RELATIONSHIPS: *Apiocera caboae* (map 10) is not very closely related to any other described species and can be easily separated from all of them by its very different proctiger (fig. 96). In the key it appears in the dichotomy with the Arizona *painteri* (map 13) but is distinct as given. Geographically it is most closely related to *linsleyi linsleyi* (map 10) and *linsleyi obliqua* (map 10), but is morphologically distinct from both in many characters. In *caboae* the proctiger is not angled upward apically (fig. 96), the claspettes are straight and the subapical lobes are moderately long, the inner interbasal folds have an elongate emargination in the dorsal margin and are rounded apically. In *linsleyi linsleyi* and *linsleyi obliqua* the apical half of the proctiger is angled upward at about a 45-degree angle (fig. 85), the claspettes are arched dorsoventrally (see fig. 65) and the subapical lobes are short and thick, the inner interbasal folds have a small postmedian emargination in the dorsal margin and the apex is sharply pointed (fig. 48). At the present time *caboae* is allopatric with all other species.

47. *Apiocera painteri* Cazier

Figures 1, 2, 8, 103; Map 13

Apiocera painteri Cazier, 1963, pp. 206–226.

DIAGNOSIS: Male: Small-sized, narrow; pteropleura bare anterior to metathoracic spiracles; dististyles gradually curved inward



MAP 10. Distributions of *Apiocera* sp.: *A. bibula*, *caloris*, *hamata*, *pearcei*, *caboae*, *spectabilis*, *linsleyi linsleyi*, *linsleyi obliqua*.

subapically, open ventrally from apex of median projection of ninth sternite to convergent tips, margins without postmedian incisions, opening not obscured by long white pile; median projection of ninth abdominal sternite without long recumbent pile, surface flat, extending posteriorly almost to anterior edge of inner interbasal folds, parchment-like lateral margins evenly rounded, gradually attenuated posteriorly to median point, overlapping dististyles laterally at widest point, posterior margin not biemarginate; compound eyes separated from lateral ocelli on vertex by more than half the width of a lateral ocellus; abdominal segment four with dorsal dark markings (fig. 103). Terminalia: Interior. Claspettes not arcuate dorsoventrally; proctiger without sickle-shaped horizontal posterior blades.

FEMALE: Abdominal dorsolateral dark maculations longitudinal, elongate, oblong;

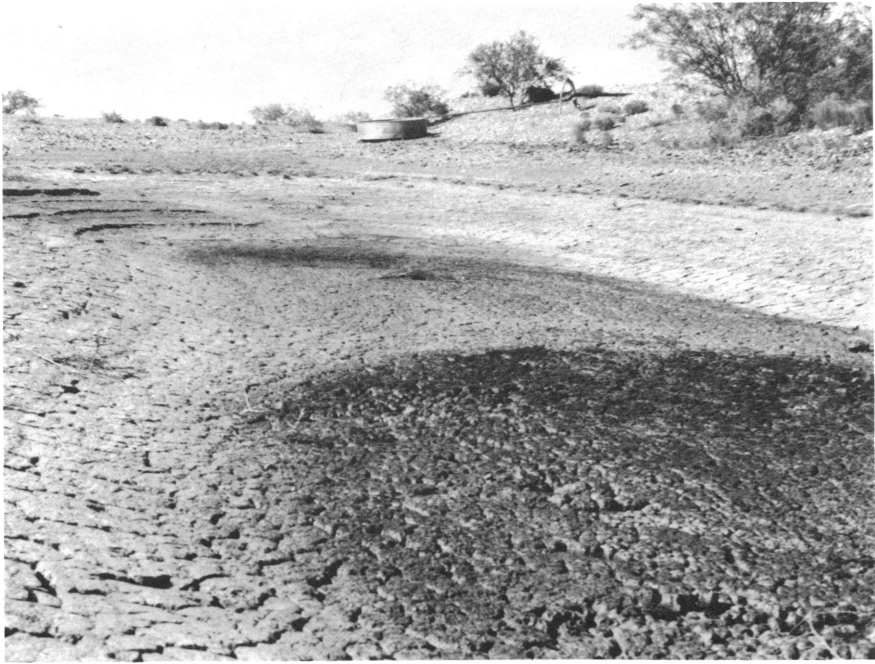


FIG. 8. Drinking site *Apiocera painteri*. Eight miles east Portal, Cochise County, Arizona.

dorsocaudal angle of mesopleura sparsely pilose; posterior surface of posterior tibiae primarily white pilose, posterior femoral macrochaetae white; abdominal segments two and three with middorsal longitudinal dark markings.

TYPE LOCALITY: 2 miles northeast Portal, Cochise County, Arizona, May 28 and June 6, 1962, M. Cazier. Holotype male, allotype female in the R. H. Painter collection at the National Museum of Natural History, Washington, D.C.

DISTRIBUTION: Arizona: Cochise County: 8 miles east Portal, May 30, 1961, M. (Statham) Favreau, M. Mortenson, M. Cazier; 2 miles northeast Portal, May 28, 1962 and June 3–4, 1963, M. (Statham) Favreau, M. Mortenson, M. Cazier; 7 miles north Portal, 0.5 mile east Harris Mountain, 4700 feet, June 11–12, 1973, O. Francke, M. Cazier; 2 miles east of highway 666 on highway 181, May 29, 1961, M. (Statham) Favreau, M. Mortenson, M. Cazier; 2 miles southeast Willcox, June 1, 1962, J. Wilcox; 23 miles

northeast Elfrida, May 20, 1961, E. M. and R. H. Painter. Pima County: Tucson, May 14, 1961, R. H. Painter and June 10, 1962, C. Gudaitis, C. Gudaitis, Jr., M. Cazier. Mexico: Sonora: Punta San Antonio, 7 miles west southwest San Carlos, April 8, 1968, E. M. Fisher.

ECOLOGY: Considerable information on the ecology, biology, and behavior of this species is available (Cazier, 1963) and like so many of the other species, *painteri* prefers sandy situations with many different plant species being used as shade. They lay their eggs in the sand and drink from moist sand or soil (fig. 8).

RELATIONSHIPS: *Apiocera painteri* does not appear to be closely related to any other described species and can be separated from most by the abdominal maculations (fig. 103) and small size. Segments two through four or five have narrow longitudinal dark maculations, segments two through seven have longitudinal dorsolateral dark maculations decreasing in size apically, segments two

through four have middorsal longitudinal maculations. The dorsolateral and middorsal maculations are usually evident on segment one, but are lighter in color. *Apiocera linsleyi linsleyi* from La Paz, Baja California Sur has similar markings (fig. 106), but its claspettes are strongly arched dorsoventrally, whereas in *painteri* they are straight. In *painteri* the apex of the proctiger is not bent upward and it has no dorsal sharp projections, the inner interbasal folds are deeply roundly emarginate apically, the dististyles have the inner margins widely separated in the apical third and the subapical ventral lobes of the claspettes are long, thin and sinuous. In *linsleyi linsleyi* the apex of the proctiger is bent upward ending in two sharp spinelike projections (fig. 85), the inner interbasal folds have a shallow median V-shaped notch in the dorsal margin (fig. 48), the inner dististyle margins are apposed in the apical one-quarter (fig. 26) and the subapical ventral lobes of the claspettes are short, straight and thick.

The only other species that resembles *painteri* (map 13) in size and abdominal maculations is *mexicana* (map 8) but the two are very different and their distributions are widely disjunct. *Apiocera painteri* lacks the following features that are present in *mexicana*. The dense erect patch of hairs on the inner surface of the locking fold, the subapical flare of long hair on the apex of the dististyles, the long, sparse recumbent pile on the median projection of the ninth abdominal sternite, the postmedian incision in the inner dististyle margins and the apposed inner dististyle margins in their apical third. From *alleni* and *auripilosa*, which appear in the key before and after *painteri*, there is little resemblance and they can be readily separated as given in the key. To date, *painteri* is allopatric to all other species.

48. *Apiocera auripilosa*, new species

Figures 9, 24; Map 11

DIAGNOSIS: Small-sized, narrow; pteropleura with sparse long white hairs in front of metathoracic spiracles; dorsocaudal angle of mesopleura black macrochaetose, brown

pilose; median projection of ninth sternite not extending posteriorly to apical third of dististyles or to transverse projections of interbasal folds, overlapping dististyles laterally at widest part when closed, posterior margin not emarginate (fig. 24); posterior tibiae black macrochaetose; compound eyes separated from lateral ocelli on vertex by more than the width of a lateral ocellus; terminalia brown, shiny; abdominal segment four with a broad black transverse vitta, sternites two through four brown or golden pilose.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex gray pruinose, brownish pilose between and behind ocelli; antennal segments one and two densely white pruinose, sparsely white macrochaetose, segment three white pruinose basally, black apically including short acute apical tooth; palpi pale yellowish, white pruinose, pilose and macrochaetose; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by slightly more than the width of a lateral ocellus, lateral ocelli separated from each other on vertex by about twice the width of an ocellus. Thorax with pronotal angles gray and tan pruinose, brown pilose and black macrochaetose; mesonotum light tan pruinose, markings brown pruinose, discal short hairs brown, sparse, marginal and submarginal pile brown, macrochaetae black; mesopleura gray pruinose sparsely brown and white pilose, dorsocaudal angle gray pruinose, sparsely brown pilose, macrochaetae black, two on one side, one on the other; wings with costal margin white pilose except for extreme tip; scutellum brown pruinose and pilose, marginal macrochaetae black. Legs with coxae gray pruinose, white pilose and macrochaetose; femora piceous, mottled gray pruinose, anterior pair white pilose and macrochaetose, middle and posterior pair brown and white macrochaetose; tibiae reddish brown, anterior and middle pairs brown and white pilose, black and white macrochaetose, posterior pair black pilose and macrochaetose; tarsi reddish brown, black and white pilose, black macrochaetose; tarsal pulvilli broad,

two-thirds as long as claws. Abdominal segments one through four golden pilose dorsally and ventrally, segments five through seven white pruinose and pilose dorsally and ventrally; segment one brown pruinose basally and medially to apical margin, dorsolateral median spots gray pruinose; segment two gray and tan pruinose basally, narrowly continuous medially, broad median black transverse vitta expanded medially almost to basal margin, broadly reaching apical margin, dorsolateral apical spots large and white pruinose; segment three black throughout; segment four narrowly white pruinose along both basal and apical margins; black dorsal markings on segments two through four extending laterally to pleural suture; sternites on segments two through four dark, mottled tan pruinose, segments five through seven white pruinose. Terminalia: Exterior. Brown, shiny, sparsely black pilose; hemitergites without subapical angle in dorsal margin, posterior margin with shallow subapical emargination; dististyles open ventrally from apex of median projection of ninth sternite to beginning of convergence toward apex, inner margins without postmedian transverse incision (fig. 24); median projection of ninth sternite flattened, bare laterally, median V-shaped area sparsely black pilose, lateral margins evenly shallowly rounded from base to acute median apical point, point extending to about middle of dististyles, not to or beyond inner projections of outer interbasal folds, margins overlapping dististyles laterally only at widest portion (fig. 24). Terminalia: Interior. Hemitergites without tuft of black pile on median base of locking fold, dorsal subapical margin with sparse, single row of black hair, tuberculate area elongate, wide, extending diagonally anteriorly and dorsally to margin; locking fold extending almost vertically from hemitergite surface, ventral margin beginning at apex, wavy anteriorly to attachment, not extending below ventral hemitergite margin; proctiger narrow dorsally, lateral margins rounded medially from basal constriction to subapical constriction, base expanded into membrane, subapically expanded downward and anteriorly as a shield, lateral shield margins reaching dor-

sum above apical arms, apical arms arcuate, narrow, extending downward on each side of aedeagus; claspettes straight, upper margin in median third membranous, margin sparsely golden pilose, apices turned sharply downward, evenly rounded, concave internally, subapical lobe thick, long, extending downward, inward and posteriorly, sparsely clothed with golden pile; outer interbasal fold acutely pointed apically, extending into opening between dististyles, inner interbasal fold widely, deeply emarginate on upper apical margin. Length 14 mm.; mesonotal width 4 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The upper head front and vertex are light tan pruinose and pilose. Mesonotum tan pruinose, markings gray pruinose, macrochaetae white or black. Pile on costal wing vein white except for tip. Legs light reddish brown, femora gray and tan pruinose, white pilose and macrochaetose, anterior and middle tibiae white pilose, black and white macrochaetose, posterior tibiae white pilose, black macrochaetose. Abdomen gray pruinose, segments two and three white pilose, dorsolateral dark maculations round, larger on segment two, middorsal median dark line on segments two and three, nonpruinose basal line on segment four. Tarsal pulvilli about two-thirds the length of the claws, width about two-thirds that in the male. Abdominal sternites two through four white pilose. Length 18 mm.; mesonotal width 4.5 mm.

TYPE MATERIAL: Holotype male, allotype female, five male and 62 female paratopotypes collected 6 miles south of Page, Coconino County, Arizona, 5400 feet elevation, June 14, 1970 by L. (Welch) Draper, O. Francke, and M. Cazier.

PARATYPES: Arizona: Coconino County: 2 miles west Moenkopi, June 13, 1966, J. Davidson, M. Cazier, one male; 5 miles east Moenkopi, June 15, 1970, L. (Welch) Draper, O. Francke, M. Cazier, one male, three females; 2 miles east Moenkopi, June 13, 1966, J. Davidson, M. Cazier, two males, 10 females; 4.5 miles east Moenkopi, June 27, 1966, J. Davidson, M. Cazier, four males, 14 females; Cliff Dwellers Lodge, July 2, 11,



FIG. 9. Habitat *Apiocera auripilosa*. Five miles east Moenkopi, Coconino County, Arizona.

1967, J. H. and J. M. Davidson, M. Cazier, one male, one female; Little Colorado River, Grand Canyon floor, Grand Canyon National Park, June 25, 1970, B. Chilton, one male; 1 mile south Bitter Spring, July 2, 1967, J. H. and J. M. Davidson, M. Cazier, two males. Apache County: Mexican Water Campground at junction United States highway 164 and County highway 12, June 16, 1970, L. (Welch) Draper, O. Francke, M. Cazier, two males. Colorado: Mesa County: Mack, July 6, 1948, M. Cazier, one male. Montezuma County: Mancos River, 28 miles south Cortez, June 21, 1961, 5500 feet altitude, R. H. and E. M. Painter, one male, one female. Four males and one female are not included in the paratype series as they are labeled only as "N. Mex."

Holotype male, allotype female and paratopotypes deposited in the collection of the American Museum of Natural History, New York. Paratopotypes and paratypes in the collection of Arizona State University, Tempe.

ETYMOLOGY: From the Latin *auri*, meaning gold or golden and *pilosa*, meaning hairy which amply characterizes the unique

condition of abdominal segments, especially the sternites, one through four which are golden pilose in this species.

ECOLOGY: The types and paratopotypes were collected in a pink sandy dune area around a cattle watering trough at the base of a windmill. The fine sand of the dunes was rather densely covered with *Chrysothamnus parryi* (Gray) Greene, *Ephedra cutleri* Peebles and several types of grass which gave shelter to the flies but from which no specimens were taken. The series of 69 specimens was attracted to the wet area around the trough which was artificially dampened by splashing water out onto the dry sand. The flies were evidently drinking as they placed their fleshy mouthparts on the wet sand as soon as they arrived. The collection was made between two and four o'clock in the afternoon during a brisk wind which was occasionally altered by heavy gusts that prevented the flies from coming in. Most of them arrived between the gusts and a few were observed attempting to buck the heavy winds. The fact that the sex ratio was severely unbalanced, six males to 63 females, may have been due to these conditions which

would imply that the females are either more powerful fliers, require more water, or that the June 14 date is late in the season. The four paratypes from 5 miles east of Moenkopi were found on light-colored fine dry sand sparsely covered with *Poliomenantha incana* (Torrey) Gray, *Ephedra cutleri* and more densely with *Mentzelia albicaulis* Douglas, various annuals and grasses (fig. 9). The flies were active beneath the shrubs and were occasionally seen on open sand in car tracks. At Mexican Water Campground, 5 miles east of Mexican Water, the two males were found along a sandy road through pink dunes which had a plant composition similar to that east of Moenkopi. At Cliff Dwellers Lodge the two specimens were collected on damp soil from a leaky faucet beneath some trees in a shaded area. One female *mortensoni* was collected at the same time and in the same small spot and all three specimens were undoubtedly attracted to the moisture from the surrounding dry dune area. The male collected on a sand bar at the confluence of the Little Colorado and the main Colorado Rivers, on the Grand Canyon floor, was taken sympatrically with *voragocolis*.

VARIABILITY: Some variability was found in the 26 males and 93 females both in the paratopotypic series and in the geographically disjunct samples. The only variation noted in the 13 males that were dissected was in the specimen from the Grand Canyon floor which had a slight angle in the membranous lateral margins of the median projection of the ninth sternite where the margins taper posteriorly to the median point. Otherwise the terminalia were remarkably uniform. In the type series two males had both black and white macrochaetae on the hind femora and one had this condition on the anterior femora, one specimen had a few white mesonotal macrochaetae. In the females three specimens had both black and white macrochaetae on the mesonotum and scutellum, four specimens had the apical third of the costal wing vein black pilose, in seven specimens the femora were largely piceous, most specimens had a faint dark longitudinal median line on the outer femoral surface, unlike the males the females had the abdominal

venter white pilose and only five specimens had golden pile on the first and second abdominal tergites. In the male from Mack, Colorado, the costal wing vein was black pilose except for the long basal white hairs. In the Mancos River, Colorado, male the costal wing vein was white pilose from the base to near the apex, but there were a few black hairs mixed with the white near the base. In the male from Cliff Dwellers Lodge the long hairs on the venter of abdominal segments two through four were pale golden, but the sclerites were dark and mottled tan pruinose. In the two males from the Mexican Water Campground there were a few black hairs on abdominal segments five through seven, one specimen had a single black macrochaeta on the posterior head surface, and a few black hairs on the base of the costal wing vein.

RELATIONSHIPS: *Apiocera auripilosa* can be easily separated from most other species by having the pile on abdominal sternites two through four brown or golden. It appears to be most closely related to *parkeri* with which it has been confused in the past due to the similarities in size, shape, and abdominal maculations. Both species occur in the Colorado River drainage, *parkeri* (map 11) occurs south of Needles, whereas *auripilosa* (map 11) has only been found north and northeast of the junction between the Little Colorado River and the Colorado River on the floor of the canyon in the northeast corner of Grand Canyon National Park. They are, therefore, allopatric with some 300 miles, including all of Grand Canyon National Park, separating their distributions and from which no specimens have been available. The two species can be separated by the brown or golden pile on abdominal sternites two through four in *auripilosa*, by its brown shiny exterior terminalia surface and by its lack of the dorsoapical proctigeal collar. In *parkeri* the ventral abdominal pile is white, the exterior terminalia surface is sparsely to densely white pruinose and dull in appearance and the proctiger has a narrow subapical collar.

Apiocera auripilosa (map 11) occurs geographically, ecologically and chronologically together with *mortensoni* (map 13) at Cliff

Dwellers Lodge and with *voragocolis* (map 9) at the junction between the Little Colorado River and the Colorado River on the floor of Grand Canyon. From *mortensoni* it can be separated as discussed under that species. From *voragocolis* it can be distinguished by its compound eyes which are separated from the lateral ocelli on vertex by more than the width of a lateral ocellus, by the brown or golden pile on abdominal sternites two through four, by having no collar on the dorsoapical portion of the proctiger, by having the lateral parchment-like extensions of the median projection of the ninth abdominal sternite gradually attenuated to the posterior median point (fig. 24), and by having the costal wing vein white pilose. In *voragocolis* the compound eyes are separated from the lateral ocelli on the vertex by less than one-half the width of a lateral ocellus, the pile on abdominal sternites two through four is white, the apex of the proctiger has a medium length dorsoapical collar (fig. 67), the lateral parchment-like extensions of the ninth abdominal sternite have rounded margins constricted inward posteriorly making the median projection long and narrow and the costal wing veins are black pilose.

49. *Apiocera calida*, new species

Figures 25, 43; Map 11

DIAGNOSIS: Small-sized, narrow; pteropleura with sparse tuft of long white hair in front of metathoracic spiracles; dorsocaudal angle of mesopleura with or without macrochaetae, pile white and brown mixed; hind tibiae with setae white; compound eyes separated from lateral ocelli on vertex by more than the width of a lateral ocellus; abdomen primarily brown or black, white dorsolateral markings on segment two or one and two; median projection of ninth sternite not extending posteriorly to apex of transverse portions of interbasal folds, overlapping dististyles laterally from about middle to posterior angles, truncate apically on both sides of median projection, posterior margins straight or shallowly emarginate (fig. 25).

DESCRIPTION: Male: Head with front

white pruinose, long white pilose, vertex black, irregularly and sparsely gray pruinose, long white pilose between and behind ocelli; antennal segments black, sparsely white pruinose, segment one white pilose and macrochaetose, segment two white macrochaetose, segment three bare, bicolored pruinosity light-colored basally, black apically, ending in short acute tooth; palpi bicolored, black in basal two-thirds, yellowish in apical third, sparsely white pruinose and pilose; posterior head surface black, margins gray pruinose, white pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by one and one-half times the width of a lateral ocellus. Thorax black, pronotal angles gray pruinose, brown pilose, black macrochaetose; mesonotal markings faint, gray and brown pruinose, surface long brown pilose, marginal and submarginal pile long brown, macrochaetae black in anterior half, white in posterior half; mesopleura black, sparsely gray pruinose around shiny bare areas, sparsely white pilose, dorsocaudal angle with tuft of long brown hair, without macrochaetae; wings with costal vein white pilose from base to near apex; scutellum black, faintly gray and brown pruinose, long white pilose, lateral margin macrochaetae white. Legs with coxae black, sparsely gray pruinose, white pilose and macrochaetose; femora black or piceous, white pilose and macrochaetose; tibiae white pilose and macrochaetose, anterior and middle piceous, posterior reddish brown; anterior and middle tarsi piceous, white pilose, black and white macrochaetose, posterior tarsi reddish brown, white pilose, black and white macrochaetose; tarsal pulvilli broad, barely shorter than claws. Abdomen black, white pilose, segment one golden pruinose basally and middorsally, subapical row of macrochaetae sparse, black; segment two with dorsolateral apical gray pruinose markings not connected medially, not reaching lateral margin; segment three black with few scattered gray pruinose spots more dense laterally; segment four sparsely narrowly gray pruinose basally, disk faintly golden pruinose, apical border black; segments five through seven black,

faintly gray pruinose; ventral surface gray pruinose, white pilose. Terminalia: Exterior. Reddish brown to piceous, sparsely white pilose; hemitergites piceous basally, reddish brown apically, lower margin evenly convex, upper margin shallowly notched at apical third, apex rounded inward at junction with internal locking fold; dististyles piceous basally, reddish brown apically, feebly gray pruinose, sparsely white pilose, inner margin not incised (fig. 25); median projection of ninth sternite flattened, white pilose, lateral margins evenly rounded to angles at apical third, overlapping dististyles for median third, posterior margin subtruncate to base of median projection, median projection pointed, not extending to internal projections of interbasal folds or to apical third of dististyles (fig. 25). Terminalia: Interior. Hemitergites sparsely black pilose apically above apex of locking fold, tuberculate area about nine tubercles wide extending from basal third of locking fold diagonally back and up almost to the dorsal margin, tubercles sparse and scattered anteriorly; locking fold semi-transparent, smooth, non-pilose, lower margin undulated, not projecting below lower hemitergite margin; proctiger wide at base, narrowing to premedian diamond-shaped dorsal flat expansion, narrowly constricted to postmedian shield extending laterally and downward posteriorly around aedeagus, posterior dorsal shield arms extending apically, parallel to each other and bent sharply downward on each side of aedeagus; claspettes straight, widened at base and apex, inner surface concave apically, upper margin membranous in apical third, ending in blunt evenly rounded projection, inner margin sparsely golden pilose, apical enlargement forming base of subapical ventral lobe, lobes long, concave on inner surface extending downward and inward to aedeagus, inner margin membranous, apical margin sparsely golden pilose; interbasal fold bilobed, outer lobe narrow, obscure, narrowly extending into ventral opening between dististyles, closely attached to inner lobe, inner lobe with apex curved inward forming broadly open half circle (fig. 43), inner surface

sparsely golden pilose. Length 16.0 mm.; mesonotal width 3.5 mm.

FEMALE: Unknown.

TYPE MATERIAL: Holotype male, 10 male paratopotypes collected 6 miles east of Parker, Yuma County, Arizona, April 6, 1967 by M. Cazier, J. Bigelow, K. Boetzer, and L. (Welch) Draper.

Holotype male deposited in the collection of the American Museum of Natural History, New York. Paratopotypes in the collection of Arizona State University, Tempe.

ETYMOLOGY: From the Latin *calida*, meaning warm or hot which aptly describes the environmental temperatures in the area in which this species lives.

ECOLOGY: All specimens were collected on the hot dry sand dunes just south of "P" mountain. It is worthy of note that two of the 11 specimens have an abundance of pale cream-colored pollen grains in the hairs of the mystax, palpi, antennal base, anterior coxae, and femora with only a scattered few adhering to the fleshy mouthparts. This may indicate pollen feeding but no conclusive direct evidence has yet been presented to support this suspicion.

VARIABILITY: Although the series of 10 paratopotypes appears to be fairly uniform in appearance they do exhibit some variability in several features. All specimens have bicolored palpi, black antennae, and white pile on the costal wing vein. Five of the specimens have macrochaetae and pile on the dorsocaudal angle of the mesopleura. The third antennal segment is concave on the underside in nine specimens and evenly rounded in two. The anterior and middle tibiae are reddish brown in six specimens and piceous in the holotype and four paratopotypes. The dorsolateral gray pruinose abdominal markings are confined largely to segment two in nine specimens, overlapping onto segment three in two specimens. In three specimens the gray pruinosity extends down the lateral margin from segment two through six. Little or no variability was found in the internal structures of the male terminalia in the nine dissected specimens.

RELATIONSHIPS: This small, dark, narrow,

primarily two-spotted species does not appear to be closely related to any others. It can be separated from *trimaculata* by having the compound eyes separated from the lateral ocelli on the vertex by more than the width of a lateral ocellus and by its primarily brown or black abdomen. The latter character will also separate it from the larger *caloris*. *Apiocera calida* (map 11) is geographically separated from *parkeri* (map 11) by only about 6 miles at Parker, Arizona, and superficially resembles it in the markings on abdominal segment two. However, *calida* is easily separated by its white instead of black pile on the terminalia and white instead of black macrochaetae on the hind femora, by its subapically expanded outer dististyle margins (fig. 43), by its truncate or shallowly biemarginate posterior margin of the parchment-like lateral extensions of the median projection of the ninth abdominal sternite (fig. 25), by its unemarginate dorsoapical margin of the inner interbasal folds (fig. 43), and by its posteriorly projecting shield arms that bend downward on each side of the aedeagus. In *parkeri* the outer dististyle margins are evenly rounded subapically (fig. 22), the parchment-like lateral extensions of the median projection of the ninth sternite have the posterior margin gradually attenuate medially (fig. 22), the inner interbasal folds have the dorsal margin deeply, roundly, emarginate subapically and the ventrally projecting subapical proctigeal arms extend downward on each side of the aedeagus (fig. 93). *Apiocera calida*, according to available data is allopatric with all other species.

50. *Apiocera pearcei* Cazier

Figure 42; Map 10

Apiocera pearcei Cazier, 1941, pp. 603–605.

DIAGNOSIS: Male: Medium to large-sized, medium to robust; pteropleura with moderate to dense long white pile; dorsocaudal angle of mesopleura with one or more strong black macrochaetae in addition to hair; terminalia primarily or entirely black or brown pilose; median posterior projection of ninth sternite without long recumbent pile, flat, lat-

eral extensions parchment-like, not deeply biemarginate but strongly angulate apically, wide, elongate, lateral margins usually subparallel and straight, broadly overlapping dististyles laterally, median posterior projection short, not extending posteriorly to outer interbasal folds which extend prominently into ventral opening between dististyles; inner dististyle margins without postmedian incision (fig. 42), margins not apposed ventrally from apex of median projection of ninth sternite to near apex, gradually curved inward to near apex (fig. 42), apex without distinct short black macrochaetae; abdominal segment four with dark dorsal markings, segments five through seven white or gray pruinose throughout, sternites two through four white pilose; costal wing vein primarily black pilose. Terminalia: Interior. Proctiger without falciform horizontal posterior blades, elongate tubular collar separating the dorsal junction of the margins of the lateral shields from the apex of the proctiger; inner interbasal folds with dorsal margin deeply emarginate apically (fig. 42); claspettes not arcuate dorsoventrally.

FEMALE: Abdominal dorsolateral dark maculations in variously shaped spots; posterior tarsal pulvilli half or more than half as long as claws; pteropleura with sparse to moderately dense long white hairs; costal wing vein predominantly black pilose, white pilose basally; dorsocaudal angle of mesopleura pilose and macrochaetose; posterior tibiae primarily black macrochaetose.

TYPE LOCATION: Phelan, San Bernardino County, California, June 26, 1937, K. L. Maehler. Holotype male, allotype female in the collection of the American Museum of Natural History, New York.

DISTRIBUTION: Arizona: Mojave County: 6 miles southeast Needles, June 11–16, 1976, Bigelow and Birduo; 2 miles east Franconia, May 30, 1969, J. Bigelow, M. Cazier; 9.6, 10, 12, 12.8, and 15 miles southeast Yucca, May 29, 1969, J. Bigelow, M. Cazier; Golden Shores, near Topock, May 30, 1969, J. Bigelow, M. Cazier. California: Inyo County: Mazourka Canyon, July 2, 1953, D. D. Linsdale; Tecopa, June 17, 1954, Belkin and

McDonald; 3 miles east Bishop, July 11, 1953, W. D. McLellan. Kern County: Short Canyon, 7 miles northwest Inyokern, August 4, 1970, M. E. Irwin; Red Rock Canyon, July 4, 1965, J. A. Chemsak, E. G. Linsley, U. Martins; Garlock, July 21, 1957, F. B. Foley; Saltdale, June 31, 1968, J. D. Birchim; Jawbone Canyon, 9.7 km. west of highway 395, June 31, 1968, J. D. Birchim. Fresno County: Ciervo Hills, 18 airmiles southwest Mendota, March 16, 1975, J. T. Doyen and July 18, 1975, J. Powell; Jacalitos Canyon, July 16, 1975, J. Powell. San Bernardino County: Yermo, July 14, 1937, W. M. Pearce; Vidal, June 19, 1949, R. F. Fritz. Riverside County: Banning, July 2, 1952, S. Miyagawa, H. I. Mathis, June 27, 1952, S. Miyagawa, B. Tinglof, July 16, 1950, J. W. MacSwain; Palm Springs Station, July 21 and 26, 1952, J. W. MacSwain; Blythe, May 17, 1947, J. W. MacSwain, E. G. Linsley. San Diego County: Palm Canyon Campground, Anza Borrego State Park, June 5, 1970, L. (Welch) Draper, O. Francke, M. Cazier. Nevada: Clark County: Overton, June 3, 1969, C. A. Heringer; 8 miles northeast Las Vegas, June 1, 1944, D. J. Zinn.

ECOLOGY: Numerous specimens of *pearcei* have been collected on the white, yellow, or bronze shiny surfaces of a motor home and automobiles at Palm Canyon Campground, and the five areas southeast of Yucca. At Golden Shores, a real estate development, they were collected on damp sand around a leaky faucet used to irrigate newly planted palm trees. At Blythe they were abundant in an apiary, perhaps being attracted by the odor of the honey.

RELATIONSHIPS: *Apiocera pearcei* appears to be most closely related to *caloris*, but can be separated by its primarily or entirely black or brown pilose terminalia and by its all black pilose and macrochaeta-like hairs on the dististyles. In *caloris* (map 10) the terminalia are primarily white pilose except for the apex of the dististyles which have short black macrochaetose-like hair. In distribution *pearcei* (map 10) is more northern but they occur together at Blythe. Superficially *pearcei* resembles *spectabilis*, but can be separated from it by its long, wide

parchment-like lateral extensions of the median projection of the ninth sternite. These extensions in *pearcei* are longer than in *spectabilis*; parallel or subparallel laterally and the posterior margin is at right angles to the lateral margins and is sometimes shallowly emarginate. The lateral margins overlap the dististyles for most of their length. In *spectabilis* the lateral membranous extensions of the median projection of the ninth sternite are shorter, the lateral margins are rounded, not subparallel, and overlap the dististyles only at the widest point (fig. 13). The posterior margins are not at right angles to the lateral margins, but are obtusely angulate or rounded to the median posterior projection (fig. 13).

Apiocera pearcei (map 10) occurs geographically, ecologically, and chronologically together with the following: *Apiocera pruinosa* (map 3) at Golden Shores (near Topock); *infinita* (map 5) and *aldrichi* (map 9) at 6 miles southeast of Needles; *wilcoxi* (map 1) at Banning; *foleyi* (map 1) at Garlock; *wilcoxi* (map 1), *acuticauda* (map 2) and *interrupta* (map 6) at Palm Springs Station; *volucra* (map 3), *alleni* (map 12) and *spectabilis* (map 10) at Palm Grove; *aldrichi* (map 9) and *caloris* (map 10) at Blythe. It is sympatric with the following: *Apiocera infinita* (map 5) and *parkeri* (map 11) at Blythe; *intonsa* (map 5) at Vidal; *hispidia* (map 9) and *arena* (map 11) at Yermo; *wilcoxi* (map 1) at Palm Springs; *ammophila hurdi* (map 13) at Palm Canyon Campground.

Apiocera pearcei can be separated from *caloris* and *spectabilis* as given above. From *interrupta*, *infinita*, *acuticauda*, *foleyi*, *volucra*, *wilcoxi*, and *intonsa* it can be easily separated by its lack of the long recumbent pile on the median projection of the ninth abdominal sternite, by having the inner dististyle margins widely separated in the apical third instead of being apposed, and by lacking the transverse postmedian incision in the inner dististyle margins (fig. 42). From *aldrichi* and *hispidia* it can be separated by its smaller size and by lacking the apical pair of horizontal, dorsoventrally flattened, falciform, sharp-pointed blades that protrude posteriorly from beneath the dorsum of the

lateral shields and above the aedeagus. From *alleni* it differs by having flat widely expanded lateral parchment-like expansions on the median projection of the ninth abdominal sternite, a short posterior median projection of the posterior margin, and by having the pile on the median projection of the sternite sparse and not projecting outward at an angle. See the discussion under *alleni* for the comparison. *Apiocera pearcei* can be separated from *parkeri*, *pruinosa*, *ammophila hurdi*, and *arena* by having the lateral parchment-like extensions of the median projection of the ninth abdominal sternite wide, elongate with margins parallel or subparallel, broadly overlapping the dististyles laterally, posterior margin angulate laterally and the median posterior projection is short and blunt. In *pearcei* the compound eyes are separated from the lateral ocelli on vertex by about the width of a lateral ocellus. In *pruinosa* they are separated by less than one-half the diameter of a lateral ocellus and in *parkeri*, *ammophila hurdi* and *arena* by about one and one-half times the width of a lateral ocellus.

Apiocera pearcei is, at the present time, the most ubiquitous of all the species. It is the most widespread in distribution and occurs in complete or partial sympatry with at least 16 other species without showing any evidence of intergradation. *Apiocera aldrichi* is sympatric with at least nine other species, many of them the same ones as with *pearcei*.

51. *Apiocera calor* Painter

Figures 21, 89; Map 10

Apiocera calor Painter, 1936, pp. 194–195.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura with sparse long white hair anterior to metathoracic spiracles; dorsocaudal angle of mesopleura with one or more white macrochaetae in addition to hair; median projection of ninth sternite flat, not extending posteriorly to transverse projections of interbasal folds, broadly overlapping dististyles laterally, lateral membranous extensions wide elongate subparallel medially, not deeply biemarginate apically, surface with-

out long recumbent pile (fig. 21), inner dististyle margins without postmedian incisions, margins not apposed ventrally from apex of median projection of ninth sternite to apex (fig. 21), apex with short black macrochaetae; terminalia primarily white pilose externally; abdominal segments five through seven white or gray pruinose throughout, sternites two through four white pilose, segment four with dorsal dark markings. Terminalia: Interior. Claspettes not arcuate dorsoventrally; dististyles slightly curved inward subapically (fig. 21); proctiger without falciform horizontal posterior blades (fig. 89), elongate tubular collar separating dorsal junction of margins of lateral shields from apex (fig. 89); inner interbasal folds with dorsal margin deeply emarginate apically.

FEMALE: Abdominal dorsolateral dark maculations in variously shaped spots; posterior tarsal pulvilli half as long as claws; pteropleura with sparse long white hair; costal wing vein white pilose; abdominal segment one white pilose; posterior tibiae primarily black or brown macrochaetose.

TYPE LOCATION: Tinijas Atlas, Yuma County, Arizona, 1905, W. J. McGee. Holotype male, allotype female in the National Museum of Natural History, Washington, D.C., catalogue number 51434.

DISTRIBUTION: Arizona: Yuma County: Dateland, May 28, 1968, M. Mortenson and June 14, 1964, A. G. Raske; 41 miles east Yuma (vicinity of Tacna), May 28, 1968, M. Mortenson; 57 miles east Yuma (vicinity of Mohawk), May 28, 1968, M. Mortenson. California: Riverside County: Blythe, May 12–19, 1947, J. W. MacSwain. Mexico: Sonora: Puerto Penasco, May 30, 1970, J. Burkhart; 5 miles south Riito, June 5, 1968, N. Leppla, J. Bigelow, M. Cazier, J. Davidson.

ECOLOGY: Series, collected at both 41 and 57 miles east of Yuma, were on damp and dry sand in an area of highway 80 that was being widened and where all vegetation had been removed. The artificially supplied moisture was from a leaky construction pipe line. At 5 miles south of Riito they were found in a dune area in which there were standing pools of water. The dunes were loosely con-

solidated with creosote-bush, *Larrea tridentata*; mesquite, *Prosopis juliflora*; bur-sage, *Franseria* species; and joint-fir, *Ephedra* species. The flies were using these plants for shade during the heat of the day and were visiting the damp sand to drink.

RELATIONSHIPS: *Apiocera caloris* appears to be most closely related to *pearcei*, but can be readily separated by its primarily white pilose terminalia. Only the apex of the dististyles is clothed with short black macrochaetae-like hairs. In *pearcei* the terminalia is primarily black or brown pilose and the apices of the dististyles are with or without the short black macrochaetae-like hairs. The two species occur geographically, ecologically and chronologically together at Blythe which is the northernmost record for *caloris* (map 10) and the southernmost for *pearcei* (map 10).

At 5 miles south of Riito and at Puerto Penasco, *caloris* (map 10) occurs geographically, ecologically, and chronologically together with *sonorae* (map 6) and at the first location also with *aldrichi* (map 9). *Apiocera caloris* can be separated from *sonorae* as discussed under that species. From *aldrichi* it can be readily separated by lacking the falciform horizontal posterior blades on the proctiger (fig. 89), by its white rather than black pile on the terminalia and by its widely expanded, subparallel-sided, lateral parchment-like expansions of the ninth abdominal sternite which overlap the dististyles laterally (fig. 21). In *aldrichi* the expansions are narrow, tumid, not parallel-sided, and do not overlap the dististyles laterally (fig. 16).

52. *Apiocera exta* Cazier

Figure 91; Map 11

Apiocera exta Cazier, 1941, p. 609.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura with long white moderately dense hair anterior to metathoracic spiracles; dorsocaudal angle of mesopleura with four strong black macrochaetae in addition to hair; median projection of ninth sternite flat, not extending posteriorly to transverse portions of interbasal folds, lateral membranous extensions elongate, lateral margins shallow-

ly rounded from basal to apical acute angles, overlapping dististyles for almost their entire length, median projection short, thick, not biemarginate apically, acutely pointed, without long recumbent pile; inner dististyle margins without postmedian incisions, margins not apposed ventrally from apex of median projection of ninth sternite to near apex, gradually curved inward subapically; abdominal segment four with dorsal dark maculations, segments two through four white pilose, segments five through seven white pruinose; compound eyes separated from lateral ocelli on vertex by less than the diameter of a lateral ocellus; terminalia brown pruinose externally. Terminalia: Interior. Claspets not arcuate dorsoventrally; proctiger without falciform horizontal posterior blades (fig. 91), without prominent subapical collar, lateral shield margins forming dorsal junction with proctiger at or slightly anterior to apex (fig. 91); inner interbasal folds with dorsal margin deeply emarginate apically.

FEMALE: Unknown.

TYPE LOCATION: Panamint Mountains, Inyo County, California, May 29, 1937, L. R. Gillogly. Holotype male in the collection of the American Museum of Natural History, New York.

DISTRIBUTION: Known only from the type location which was probably along state highway 190 somewhere near Townes Pass, elevation 4956 feet or on the side road south toward summer park headquarters. In the bottom of Death Valley only *hispida* (map 9) has been taken and going west to the area of Panamint Springs only *haruspex atrifasciata* (map 4) is known.

ECOLOGY: No information available.

RELATIONSHIPS: *Apiocera exta* (map 11) appears to be most closely related to *arena* (map 11) whose distribution is east, west and south of that of *exta*. In *exta* the compound eyes are separated from the lateral ocelli on the vertex by less than the diameter of a lateral ocellus, whereas in *arena* they are separated by more than the diameter of a lateral ocellus. In *exta* the exterior of the terminalia is brown pruinose, whereas in *arena* it is white or gray pruinose. To the north in Inyo County at Deep Springs and Antelope

Springs is *macswaini* (map 11) that superficially resembles both *exta* and *arena*; however, it can be distinguished from both by its lateral membranous extensions of the median projection of the ninth sternite which are short with either rounded or strongly divergent lateral margins. In both *exta* and *arena* these lateral extensions are long with subparallel margins. In *macswaini* these lateral extensions narrowly overlap the dististyles at their widest point, whereas in *arena* and *exta* these lateral extensions because of their length and subparallel margins, broadly overlap the dististyles laterally. In *exta* the pile on the costal wing vein is black except for the longer basal hairs, whereas in *arena* this pile is white except in the apical one-quarter.

From *haruspex atrifasciata* and *haruspex haruspex*, *exta* can be readily separated by lacking the long recumbent pile on the ninth sternite, and the postmedian incision in the inner dististyle margin which are both present in *haruspex atrifasciata* and *haruspex haruspex* (see figs. 14, 32). In *exta* the median projection of the ninth sternite is expanded laterally, overlapping the dististyles and the inner dististyle margins are widely separated in the apical third. In *haruspex atrifasciata* and *haruspex haruspex* the median projection is not expanded laterally, does not overlap the dististyles and the inner dististyle margins are apposed in the apical third (see fig. 14). In *exta* the inner interbasal folds have a single deep emargination in the dorsoapical margin, whereas in *haruspex atrifasciata* and *haruspex haruspex* this margin is biemarginate (see fig. 38). There are many other differences and the two species are only distantly related.

From *hispida*, *exta* can be separated by its smaller size and by lacking the horizontal, dorsoventrally flattened, sickle-shaped, sharp-pointed blades (fig. 91) that protrude posteriorly from beneath the lateral shield on the proctiger in *hispida* (see fig. 87). In *exta* the lateral extensions of the ninth sternite overlap the dististyles, whereas in *hispida* the extensions are tumid and do not overlap the dististyles. There are many other differences and the two species are only distantly

related. At the present time *exta* is allopatric with all other known species.

53. *Apiocera arena*, new species

Figure 90; Map 11

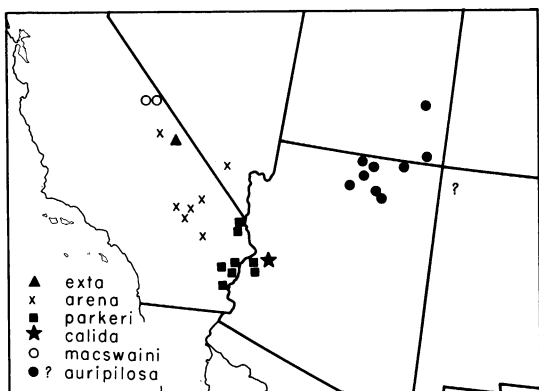
DIAGNOSIS: Small to medium-sized, narrow; pteropleura with moderate tuft of long white hair in front of metathoracic spiracles; dorsocaudal angle of mesopleura with one to five macrochaetae in addition to white and brownish pile; median projection of ninth sternite not extending to transverse projections of interbasal folds, overlapping dististyles laterally for about middle half; hind tibiae primarily or entirely black macrochaetose; compound eyes separated from lateral ocelli on vertex by more than the width of a lateral ocellus; terminalia white pruinose in large part, dististyles brown pilose; ocelli on vertex separated from each other by more than the width of a lateral ocellus; pile on costal wing vein primarily white; abdominal segment five white pruinose dorsally; abdominal segments three and four with wide dorsolateral white pruinose basal bands, segment four with narrow white pruinose apical band, segments one and two with dorsal pile primarily white.

DESCRIPTION: Male: Head with front and vertex white pruinose and pilose; antennal segments black, segments one and two white pruinose, pilose and macrochaetose, segment three white pruinose, ending apically in short acute tooth; palpi white pruinose and pilose, terminal segment pale yellow; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about one and one-half times the width of a lateral ocellus, ocelli on vertex separated from each other by almost twice the width of a lateral ocellus. Thorax with pronotal angles gray pruinose, brown pilose and black macrochaetose; mesonotum gray and brown pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile brown and white mixed, macrochaetae black; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle sparsely brown and white pilose, macro-

chaetae black; wings with costal margin white pilose in basal two-thirds; scutellum gray pruinose, long white pilose, submarginal macrochaetae black. Legs with coxae and femora black, tibiae and tarsi reddish brown; coxae gray pruinose, white pilose and macrochaetose; anterior and middle femora gray pruinose, brown and white pilose, white macrochaetose, posterior femora gray pruinose, black and white macrochaetose; tibiae brown and white pilose, sparsely gray pruinose in part, black and white macrochaetose, posterior tibiae primarily black macrochaetose; anterior and middle tarsi brown and white pilose, black macrochaetose, posterior tarsi brown pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen white pruinose, black maculose; segment one white pilose, dense laterally, basal half brown pruinose, basal vitta broadly expanded medially, reaching apical margin, dorsolateral white pruinose elongate spots interrupted medially, reaching apical margin, subapical margin with a row of black macrochaetae; segment two with light brown and gray transverse basal vitta, median wide black transverse vitta expanded medially but not reaching basal or apical margins, apical third with white vitta constricted narrowly at middle, broadly continued on base of segment three, pile primarily white, median dark maculations brown and white pilose; segment three broadly black from apical margin to midbasal margin, dorsolateral white pruinose broad vitta continuous with those on segment two, pile white laterally, brown on dark markings; segment four as on segment three except that basal dorsolateral white vitta is narrow, apical margin narrowly white pruinose; segments five through seven white pruinose and pilose dorsally and ventrally; segments two through four gray pruinose and white pilose; dorsal black transverse vittae on segments two through four broadly continuing to pleural suture. Terminalia: Exterior. Reddish brown, densely gray pruinose, sparsely black pilose; hemitergites with dorsal margin shallowly angulate at posterior one-quarter, apex bluntly rounded, ventral margin shallowly indented below apex, median ventral area without pruinosi-

ty; dististyles open ventrally from apex of median projection of ninth sternite to near apex, apices bluntly rounded; median projection of ninth sternite flattened, bare laterally, median narrow V-shaped area with long black pile, lateral membranous margins shallowly rounded from base to anterior angles, overlapping dististyles in median third, posterior margin abruptly constricted to base of short median acute projection, median projection not reaching base of interbasal folds that protrude into ventral opening between dististyles. Terminalia: Interior. Hemitergites with sparse black pile along dorsal subapical margin, base of locking fold without tuft of pile, tuberculate area narrow elongate extending anteriorly and dorsally from inner base of locking fold almost to dorsal margin, locking fold strongly angulate from hemitergite surface in posterior half, gradually lowering and turning upward to basal attachment, posterior margin continuous with dorsal hemitergite margin, ventral margin not extending below ventral hemitergite margin; proctiger wide at base narrowed subapically anterior to lateral shieldlike projections, shield extending downward and slightly toward base, dorsal shield margins reaching dorsum of proctiger subapically, apex rounded, subapical ventral armlike acutely pointed projections extending downward on each side of aedeagus (fig. 90); claspettes straight, slightly angulate inward from base to apex, dorsal margin membranous only subapically, margin sparsely golden pilose, apices turned downward, bluntly rounded posteriorly, subapical lobes long, extending downward and inward toward aedeagus, concave internally, gradually narrowing from base to apex, sparsely golden pilose; outer interbasal fold broadly expanded apically, ventral angle extending into opening between dististyles, inner interbasal fold deeply openly emarginate dorsoapically. Length 18 mm.; mesonotal width 4 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The upper front of head and vertex are tan pruinose, brown pilose. The mesonotum is tan pruinose with brown pruinose markings, marginal and submarginal macrochaetae



MAP 11. Distributions of *Apiocera* sp.: *A. exta*, *arena*, *parkeri*, *calida*, *macswaini*, *auripilosa*.

black and white mixed. Legs white pruinose and pilose, black and white macrochaetose. Abdominal segments two and three with large central dorsolateral dark maculations, segment three with middorsal basal dark spot. Length 20 mm.; mesonotal width 5 mm.

TYPE MATERIAL: Holotype male, allotype female, 89 male and 18 female paratopotypes collected 7 miles northeast of Newberry, San Bernardino County, California, May 18, 1968 by N. Foster, J. Bigelow and M. Cazier.

PARATYPES: California: San Bernardino County: Newberry, May 18, 1968, N. Foster, J. Bigelow, M. Cazier, five males, four females; 3 miles north 29 Palms, May 11, 1968, N. Foster, M. Cazier, 29 males, two females; 2 miles northeast 29 Palms, May 24, 1966, J. Wilcox, two males, three females; Yermo, May 23, 1940, W. Reeves, P. Ting, M. Cazier, three males, one female; 2 miles south of Cronise Lake, May 4, 1966, M. Jay, J. Davidson, four males, two females, May 20, 1978, James O'Grady, two males, one female; 3 miles south Cronise Lake, May 20, 1978, James O'Grady, two males, one female; Cronise Valley, May 5, 1960, A. Menke, four males, three females; 9 and 5 airmiles south Baker, Zzyzx Springs, April 20, 23–27, 1977, Buegler, Powell, Chemsak, Ulrich, Cave, Kitayama, 164 males, 235 females; Basin Road, 16 miles

southwest Baker, April 25, 1977, J. Chemsak, one mating pair. Inyo County: At 4.6 miles northwest Keeler, June 9, 1970, L. (Welch) Draper, O. Francke, M. Cazier, one male. Nevada: Clark County: Kyle Canyon, Charleston Mountains, May 28, 1940, W. Reeves, P. Ting, M. Cazier, one male.

Holotype male, allotype female and paratopotypes are deposited in the collection of the American Museum of Natural History, New York. Paratopotypes and paratypes are in the collections of the University of California at Berkeley and Davis, the private collection of Joe Wilcox, Anaheim, California, and in the collection of Arizona State University, Tempe, and that of Larry Bezark, Sacramento, California.

ETYMOLOGY: From the Latin *harena*, meaning sand which appears to be the prime requisite in the habitat of this species.

ECOLOGY: Specimens from the type locality were collected in and adjacent to a real estate development containing a large lake situated on the east side and at the base of a large unconsolidated dune field. Most of the series of 109 specimens were collected as they came into artificially created wet areas at the base of a dune but a few, especially females, were found on the dunes or the dry flat sandy areas at their base. In the series of paratypes from or near Zzyzx Springs, 107 females and 46 males were collected in a "malaise trap," nine males and three females were found in "flight traps," one male was found emerging from its pupal skin in a sandy area, and several specimens were collected on sand dunes south of Zzyzx Springs. The male paratype from near Keeler was found on a light-colored sand dune on the north edge of Owens Lake and was flying around and under *Atriplex* species and clumps of grass on the dry dune. One female collected near 29 Palms bears a label reading "prey of *Efferia candida* Coquillett, determined J. Wilcox."

VARIABILITY: Comparatively little variability was found in the 215 (171 males, 44 females) specimens studied and in the 48 males whose terminalia were opened to expose the internal structures. In the paratopotypical males the pile on the vertex of the

head varied from being all brown to all white and in one specimen the brown pile extended below the median ocellus. The compound eyes were usually separated from the lateral ocelli on the vertex by about one and one-half times the width of a lateral ocellus but they varied from the diameter to twice the diameter in a few specimens. Two specimens had only one white macrochaeta on one side of the dorsocaudal angles of the mesopleura and one specimen had only two white macrochaetae on one side. The rest of the series had two to five black macrochaetae on each side. Two specimens had piceous tibiae and in one they were testaceous instead of the characteristic reddish brown. The basic color of the antennal segments and femora was always black. The membranous lateral margins of the median projection of the ninth sternite were usually subparallel medially but in a few specimens they were shallowly rounded or slightly convergent toward the base. In all specimens the margins were strongly angulate subapically and abruptly convergent to the base of the median projection. The pile on the dorsum of abdominal segments one through three varied from being primarily white to being primarily brown. In the 29 males from 3 miles north of 29 Palms, one specimen had the tibiae black and two had them piceous. In the Yermo males the color of the femora and tibiae varied from black to piceous. One male from 2 miles south of Cronise Lake was teneral and uniformly lighter in color throughout. The male from Kyle Canyon had antennal segments one and two piceous rather than black. The 44 female specimens were remarkably uniform in all respects.

RELATIONSHIPS: *Apiocera arena* appears to be most closely related to *parkeri* and *exta* but only distantly related to *hispid*a with which it occurs sympatrically in at least two locations. From *exta* it can be separated by having the outer transverse projections of the interbasal folds extending prominently into the ventral opening between the dististyles, by having the costal wing vein white pilose for almost its entire length, by having shorter straight internal lobes of the clas-

pettes and by having the compound eyes more widely separated from the lateral ocelli on the vertex. In *exta* they are separated by less than the diameter of a lateral ocellus on the vertex. From *parkeri* it can be easily separated by having the dorsal white apical maculations on abdominal segment two broadly continued on segment three especially dorsolaterally, by its shorter straight internal lobes of the claspettes, by its subapically angulate lateral margins of the median projection of the ninth sternite and short median projection. In *parkeri* these lateral margins are strongly evenly rounded and gradually convergent posteriorly into a long median projection.

Four male specimens of *parkeri* (map 11) were taken with the 29 males of *arena* (map 11) at 3 miles north of 29 Palms but can be morphologically separated as given above. Although the two species were obviously sympatric at the collecting site they may or may not utilize the same habitat for breeding. The same may also apply in the case of *hispid*a (map 9) females which have been collected sympatrically with *arena* at the Yermo and Cronise Lake localities. The females of *arena* have entirely white pilose costal wing veins, whereas in *hispid*a they are black or brown pilose except basally where they may be black pilose or black and white mixed. In the males of *hispid*a the median projection of the ninth sternite does not overlap the dististyles laterally and the costal wing margins are entirely or primarily black pilose. In *arena* the median projection of the ninth sternite overlaps the dististyles laterally and the costal wing vein is white pilose. For further comparison with *hispid*a see the discussion under that species. At Yermo both *hispid*a (map 9) and *pearcei* (map 10) occur sympatrically with *arena* (map 11) but the dates are separated by about two months, *hispid*a and *arena* in May, *pearcei* in July. *Apiocera arena* can be separated from *pearcei* by its smaller size, by lacking the subapical dorsal collar on the proctiger (fig. 90) and by its less widely expanded lateral parchment-like portions of the posterior extensions of the ninth abdominal sternite.

54. *Apiocera parkeri* Cazier

Figures 22, 93, 111; Map 11

Apiocera parkeri Cazier, 1941, pp. 607–609.

DIAGNOSIS: Male: Medium-sized, narrow; pteropleura with moderately dense long white pile anterior to metathoracic spiracles; dorsocaudal angle of mesopleura with one or more strong black macrochaetae; median projection of ninth abdominal sternite without long recumbent pile, not extending posteriorly to transverse projections of interbasal folds, lateral parchment-like extensions flat, overlapping dististyles only at widest portion, not deeply biemarginate apically (fig. 22); posterior tibiae predominantly black macrochaetose; compound eyes separated from lateral ocelli on vertex by more than one-half the width of a lateral ocellus; terminalia gray pruinose externally, dististyles black or brown pilose, inner margins without postmedian transverse incisions, margins not apposed ventrally from apex of median projection of ninth sternite to near apex, gradually curved inward subapically (fig. 22); costal wing vein white pilose; abdominal segment four with dorsal dark markings (fig. 111), sternites two through four white pilose, segments five through seven gray pruinose throughout. Terminalia: Interior. Claspettes not arcuate dorsoventrally from base to apex; proctiger without sickle-shaped horizontal posterior blades (fig. 93); inner interbasal folds with dorsal margin deeply emarginate apically.

FEMALE: Abdominal dorsolateral dark maculations in the form of spots; posterior tarsal pulvilli more than half as long as tarsal claws; pteropleura with sparse to moderately dense long hair; costal wing vein predominantly white pilose; abdominal sternites one through five primarily white pilose; posterior tibiae primarily black or brown macrochaetose.

TYPE LOCALITY: Blythe, Riverside County, California, April 19, 1939, F. H. Parker. Holotype male, allotype female in the American Museum of Natural History, New York.

DISTRIBUTION: Arizona: Yuma County: 6 miles southeast Parker, April 23, 1966, J. H. and J. M. Davidson, M. Cazier; 8 miles

southeast Parker, April 22, 1966, J. H. and J. M. Davidson, M. Cazier, and May 29, 1966, S. A. Gorodenski; 18 miles southeast Parker, May 7, 1966, J. H. and J. M. Davidson, S. A. Gorodenski, M. Cazier; 8.5 miles north Quartzsite, May 14, 1966, J. H. and J. M. Davidson, M. Cazier; 14 miles north Quartzsite, May 14, 1966, J. H. and J. M. Davidson, M. Cazier. California: Imperial County: 3 miles south Palo Verde, April 8, 1949, and April 9, 1963, P. D. Hurd. Riverside County: 20 miles west Blythe, April 27, 1939, F. H. Parker; Hopkins Well, April 29, 1952, J. G. Rozen, G. A. Marsh, P. D. Hurd; 4 miles south Ripley, April 30, 1952, P. D. Hurd. San Bernardino County: Needles, April 25, 1949, C. D. MacNeill; Lake Havasu, April 15, 1966, M. A. Brusven, D. L. Coates.

ECOLOGY: At Blythe many specimens have been collected in sandy areas along the Colorado River. At 6 and 8 miles southeast of Parker they were found in an irrigation canal overflow area at the base of a loose sand dune. In the two areas near Quartzsite they were in sandy dry creek beds.

RELATIONSHIPS: *Apiocera parkeri* (map 11) resembles *auripilosa* (map 11) which occurs on the upper Colorado River drainage but the two are easily separated as given under *auripilosa*. *Apiocera calida* (map 11) occurs 6 miles east of Parker in a large dune area at the base of Parker (P) Mountain. Although the two are in the same general area they are allopatric and are easily separated by the piceous abdominal segments five through seven in *calida*, and its truncate or shallowly biemarginate posterior margin of the parchment-like lateral expansions of the median projection of the ninth abdominal sternite (fig. 25). Also, *calida* is smaller than *parkeri*.

Apiocera parkeri (map 11) occurs sympatrically with *aldrichi* (map 9), *pearcei* (map 10), *caloris* (map 10), and *infinita* (map 5) at Blythe, but at least at this location, *parkeri* records indicate an earlier occurrence, April, than the other species which are only distantly related. At 20 miles west of Blythe *parkeri* occurs geographically, ecologically, and chronologically together with *aldrichi*,

also in April. *Apiocera parkeri* can be separated from *aldrichi* by lacking the horizontal, dorsoventrally flattened, falciform blades that protrude posteriorly from beneath the lateral shield of the proctiger and above the aedeagus (fig. 93), its smaller size, narrower shape, more widely separated compound eyes and many other differences. It lacks the dense pad of pile on the locking fold, the recumbent pile on the ninth abdominal sternite and postmedian transverse incision in the inner dististyle margins (fig. 22) which are present in *infinita* (fig. 29). There are many other differences.

Apiocera parkeri differs from both *pearcei* and *caloris* by having a very short dorsal subapical collar on the proctiger (fig. 93), by having the compound eyes separated from the lateral ocelli on the vertex by more than the width of a lateral ocellus, by having the parchment-like lateral expansions of the posterior projection of the ninth abdominal sternite with rounded lateral margins and long, acute, median projection (fig. 22), and by the almost entirely dark dorsal surfaces on abdominal segments three and four (fig. 111). In both *pearcei* and *caloris* the subapical proctigeal collar is long (fig. 89), the compound eyes are separated from the lateral ocelli on the vertex by the width or less than the width of a lateral ocellus, the parchment-like lateral expansions are elongate, the side margins are parallel or subparallel and the median posterior projection is short and blunt (fig. 21), and the dorsal surface of abdominal segments three and four have wide white pruinose basal and apical transverse bands.

55. *Apiocera rockefelleri*, new species

Figure 105; Map 7

DIAGNOSIS: Medium-sized, narrow; pteropleura bare, gray pruinose in front of metathoracic spiracles; dististyles open ventrally from apex of median projection of ninth sternite to convergent tips of dististyles, median projection of ninth sternite overlapping dististyles laterally for almost its entire length, surface strongly convex, apex of dististyles pointing straight behind, outer subapical

margins convex; terminalia dark reddish brown, venter primarily brown pilose; abdominal segments six and seven white pruinose, dorsolateral dark markings on segments two through four subtriangular, widely separated; legs with hind femoral macrochaetae primarily white; terminalia proctiger without lateral apical arms, apical one-quarter of proctiger bent sharply upward; subapical incision of interbasal fold parallel-sided, narrow.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex behind posterior ocelli brown pilose; antennal segments reddish brown, segments one and two white pruinose, pilose and macrochaetose, segment three bare, bitextured reddish brown pruinose, ending in short acute tooth; palpi faintly yellowish, white pruinose and pilose; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about the width of a lateral ocellus. Thorax with pronotal angles gray pruinose, brown and white pilose and macrochaetose; mesonotum primarily gray pruinose, brown pilose, marginal and submarginal macrochaetae primarily white; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle brown and white pilose, nonmacrochaetose; wings with costal margin white pilose from base to apical third; scutellum gray pruinose, white and brown pilose and macrochaetose. Legs bicolored, femora dark reddish brown, tibiae testaceous; coxae white pruinose, pilose and macrochaetose; anterior and middle femora white pilose and macrochaetose, hind femora brown and white pilose, primarily white macrochaetose; anterior and middle tibiae white and brown pilose and macrochaetose, posterior tibiae brown pilose and macrochaetose; anterior and middle tarsi brown and white pilose, black macrochaetose, hind tarsi brown pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen (fig. 105) with segment one gray pruinose, white pilose, subapical margin with row of black macrochaetae, middorsum with irregular dark spot; segment two gray pruinose, white pilose basally and laterally, brown pi-

lose apically and on dark markings, dorso-lateral dark markings subtriangular (lunate), inner margin shallowly emarginate, middorsal area with irregular longitudinal dark line; segments three and four gray pruinose, white pilose laterally, sparsely brown pilose dorsally, dorsolateral dark markings subtriangular, inner margin straight, middorsal longitudinal dark line extending from base to apical third; segments five through seven white pruinose and pilose, segment five with small indistinct dorsolateral dark spot, segments six and seven without maculations; ventral surface of all segments white pilose. Terminalia: Exterior. Dark reddish brown; hemitergites shiny, not pruinose, sparsely brown pilose; dististyles faintly gray pruinose, sparsely brown pilose; median projection of ninth sternite strongly convex (before dissection), lateral thirds of surface strongly brown pruinose, median line brown pilose apically, brown and white pilose basally, lateral margins diverging from base to apical angles, posterior margin shallowly angulate to short median projection, marginal area bent inward, not reaching interbasal folds. Terminalia: Interior. Hemitergites without dense tufts of black pile, minutely tuberculate area in dorsal apical third above base of locking fold, subapical area with sparse black pile, subapical locking folds heavily sclerotized, smooth, extending below lower edge of hemitergite, ventral margin straight, fold not strongly angulate away from hemitergite surface; proctiger narrow in basal two-thirds, membranous at base, shallowly constricted at apical third, widened apically and bent upward at about a 45-degree angle, narrowed at apex, posterior surface narrow, vertical, dorsal angles extending vertically into two needle-like projections, ventral angles extending laterally and downward as fine needle-like projections over but not touching the aedeagus; claspettes broad, flattened laterally, enlarged at base and apex, arched from base to apex, and bent inward toward middle, subapex with small evenly rounded projection, subapical lobe extending below and inward from projection, angulate and membranous, dorsal claspette surface with few short golden hairs, ventral surface

near base with long evenly spaced curved golden hairs, inner surface concave; interbasal folds acutely pointed, apices extending prominently into ventral opening between dististyles, subapical inner margin with parallel-sided angulate deep groove extending posteriorly almost to middle. Length 18 mm.; mesonotal width 3.5 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The front of the head is tan pruinose, third antennal segment dark; pronotal angles black macrochaetose; mesonotum dark and light tan; costal wing margin with few black hairs; second and third abdominal segments with narrow elongate dorsolateral dark bands, segment four with retrorse white hair, segments five through seven with retrorse pile brown; femora white pilose and macrochaetose, tibiae white pilose, black and white macrochaetose; tarsal pulvilli narrower than in the male, two-thirds as long as claws; digging spines at apex of abdomen short blunt and brown, 10 on each side of genital opening. Length 14 mm.; mesonotal width 3.5 mm.

TYPE MATERIAL: Holotype male, allotype female and three female paratopotypes collected at Samalayuca, Chihuahua, Mexico, June 24, 1947 by M. Cazier while on the David Rockefeller Mexican Expedition of the American Museum of Natural History, New York.

PARATYPES: Mexico: Chihuahua: Villa Ahumada, June 28, 1947, M. Cazier, one male; 10 miles south of Villa Ahumada, July 4, 1954, J. W. MacSwain, one male. Texas: Loving County: 28 miles north Mentone, August 6, 1979, O. F. Francke, J. V. Moody, F. W. Merickel, 10 males, 24 females. Reeves County: Orla, August 5, 1931, Dr. R. H. Painter, one male, one female.

Holotype male, allotype female and one female paratopotype in the collection of the American Museum of Natural History, New York; paratopotypes and paratypes in the Arizona State University Collection, Tempe; the collection of the California Insect Survey, University of California, Berkeley; and in the collection of Texas Tech University, Lubbock.

ETYMOLOGY: The species is named after Dr. David Rockefeller in grateful acknowledgment for his making possible this extensive 1947 collecting expedition to Mexico.

ECOLOGY: The holotype, allotype, and three paratopotypes were collected in the dry sandy areas along the western edge of the large, unconsolidated, windblown, light-gray-colored dune field known as the Samalayuca Sands. The specimen from Villa Ahumada was taken on a dirt embankment of an irrigation ditch and appeared to be drinking from the moist soil. The males from 28 miles north of Mentone were found in a muddy depression in the clay substrate whereas the females were in the shade of adjacent vegetation; *Prosopis juliflora*, mesquite; *Xanthocephalum* sp.; *Acacia* sp.; Cruciferae sp., mustards; and *Gutierrezia* sp., broom-weed. According to Dr. Francke (personal commun.) the soil on the level terrain was a sandy loam where about one-quarter of the specimens were collected in the shade between 2:30 and 3:00 P.M. Most of the specimens were collected along the muddy shore of a small cattle watering tank.

VARIABILITY: There is little or no variability in the type series and particularly in the major characteristics. All four males have the hemitergites and dististyles opened and showed no variability in the internal structures which are definitive. The male from Orla is tan instead of gray but the 10 males from 28 miles north of Mentone are gray as in the type series. The dorsolateral markings on abdominal segments two through four vary slightly in size and may be triangular in shape with the inner margin straight or sublunate with the inner margin shallowly emarginate. In the holotype and the Orla male there is a small faint brown dorsolateral spot on segment five which is lacking in the other 11 males. None of the specimens have any maculations on abdominal segments six and seven. In the males from 28 miles north of Mentone the terminalia are piceous instead of reddish brown as in the rest of the series.

RELATIONSHIPS: *Apiocera rockefelleri* appears to be most closely related to *femoralis* but can be separated from it by its lighter

gray to tan color, disjunct dorsolateral dark abdominal marking (fig. 105) on segments two through four, and by lacking the dorsolateral dark markings on abdominal segments five through seven. In *femoralis* the color is a darker gray, but the larger, usually connected, dark abdominal maculations (fig. 104) gives it a much darker appearance. However, the well-defined dark dorsolateral maculation on segment five (fig. 104) and usually on segments six and seven are more definitive. From *franckei*, *rockefelleri* can be separated by lacking the dorsolateral projections on the apex of the proctiger (fig. 81) and by having the apical third of the proctiger bent sharply upward (see fig. 84). In *franckei* the proctiger is divided apically into long lateral hornlike projections on each side (fig. 81) and the apical third is only slightly elevated, not sharply bent vertically.

Apiocera rockefelleri (map 7) occurs geographically, ecologically, and chronologically together with *bilineata* (map 5) at Villa Ahumada, but the two are only distantly related as can be seen in the discussion under the latter species.

56. *Apiocera spectabilis*, new species

Figures 10–13, 39, 66; Map 10

DIAGNOSIS: Large-sized, robust; pteropleura with moderately dense tuft of long white hair in front of metathoracic spiracles; dorsocaudal angle of mesopleura with three strong black macrochaetae in addition to brown and white hair; median projection of ninth sternite flat not emarginate apically or extending posteriorly to apex of transverse portions of interbasal folds, overlapping dististyles laterally in median third (fig. 13); hind tibiae with black macrochaetae; compound eyes separated from lateral ocelli on vertex by less than one-half the width of a lateral ocellus; terminalia piceous, with scattered piceous or brown pruinosity; hind femoral macrochaetae black, ground color piceous; dark markings on dorsum of abdominal segments three through four in wide transverse bands, sternites two through four white pilose; transverse projections of interbasal folds extending into ventral open-

ing between dististyles (fig. 13); outer subapical margins of dististyles evenly rounded (fig. 13); posterior ventral margin of hind femora with moderate to dense long stout black macrochaetae; upper margin of anterior femora with macrochaetae primarily black.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex brown pilose; antennal segments one and two white pruinose, pilose and macrochaetose, segment three bare, primarily dark in color; posterior head surface white pilose, pruinose and macrochaetose; palpi white pruinose and pilose. Thorax with pronotal angles black macrochaetose, brown pilose, light tan pruinose; mesonotum brown pilose, markings brown pruinose, light areas tan pruinose, marginal and posterior discal macrochaetae black; mesopleura white pruinose and pilose; wings with costal margin black pilose except for a few white hairs at base; scutellum brown and gray pruinose, brown pilose, posterior margin black macrochaetose laterally. Legs with ground color piceous; anterior coxae white pruinose, pilose and macrochaetose, middle and hind coxae white pruinose and pilose, black and white macrochaetose; anterior and middle femora white pruinose and pilose, black macrochaetose, posterior femora white pruinose, dorsal margin white pilose, sides and venter black pilose, ventral margin with strong black macrochaetae; anterior and middle tibiae white pruinose and pilose, black macrochaetose, posterior tibiae brown pruinose, black macrochaetose; anterior and middle tarsi brown and white pilose, black macrochaetose, posterior tarsi brown pilose, black macrochaetose; pulvilli broad, over two-thirds as long as claws. Abdomen white pruinose, except for dark markings, white pilose except for brown and black pile along apical margin of segment one, on dark markings on segments one through four and sparse middorsal hairs on segments five through seven; segment one with subapical row of black macrochaetae, basal brown pruinose marking expanded medially, broadly reaching apical margin; segment two with middorsal narrow transverse black band expanded medially, narrowly reaching basal

and apical margins; segment three with wide middorsal transverse black band shallowly expanded medially reaching basal and apical margins; segment four with wide middorsal transverse black band expanded medially narrowly reaching basal margin, not reaching apical margin; indistinct lateral markings on segments two and three, distinct lateral marking on segment four broadly connected with dorsal transverse band; lateral margins of segments one through four with long dense white pile. Terminalia: Exterior. Hemitergites and dististyles piceous, sparsely brown pruinose and pilose; median projection of ninth sternite brown pruinose, black pilose, lateral membranes brown, overlapping dististyles laterally in middle third, projecting posteriorly to about middle of dististyles, reaching base of prominent transverse projections of interbasal folds, margins angulate at apical one-quarter, narrowly transverse, extending medially to blunt median apical point (fig. 13). Terminalia: Interior. Hemitergites without dense tufts of black pile; subapical locking fold heavily sclerotized, margin even or undulated, not wrinkled, extending inward at about a 45-degree angle from surface; sparse black hairs above apical half of locking fold; apical angulate margin densely tan pruinose; tuberculate area small, about midway between apex and basal muscle attachment in upper half; proctiger with base triangularly expanded above, lateral projections narrow, extending downward at an angle of about 90 degrees, lateral apical arms extending downward enclosing the aedeagus, not extending apically (fig. 66); claspettes straight, enlarged at base, enlarged and flattened at apex, sparsely golden pilose, extending diagonally inward from base to apex, inner subapical lobes long, broadly flattened in basal half, narrow and angulate in apical half, extending downward and inward, moderately densely clothed with golden pile (fig. 66); interbasal folds large, extending posteriorly to about middle of dististyles, deeply and roundly excavated apically (fig. 39), prominently visible in ventral opening (fig. 13). Length 24 mm.; mesonotal width 5.5 mm.

FEMALE: Similar to the male except that



FIG. 10. Drinking site *Apiocera spectabilis*. Las Arrastras, Baja California Norte, Mexico.

compound eyes are separated from lateral ocelli on vertex by about three times the width of a lateral ocellus; pruinosity of upper half of the front, back and vertex of head tan; mesonotum primarily tan pruinose, marginal macrochaetae black and white; middle and hind coxae white macrochaetose, femora white macrochaetose, hind tibiae white pilose; abdominal segments two through four with large dorsolateral dark spots, segments one and two with indistinct lateral spots, segments four and five clothed with retrorse white pile, segment six with retrorse pile black dorsally and ventrally white laterally, segment seven with retrorse pile black; digging spines at apex of abdomen surrounding genital opening strong black and with nine on each side. Length 22 mm.; mesonotal width 5 mm.

TYPE MATERIAL: Holotype male and 124 male paratopotypes, allotype female and 193 female paratopotypes collected at Las Arrastras, Baja California Norte, Mexico, June 15, 1968 by N. Leppla, J. Davidson, J. Bigelow, M. Bentzien, W. Fox, S. Williams and M. Cazier.

PARATYPES: Mexico: Baja California Norte: 2.5 miles southwest San Borja, June 21, 1968, same collectors as holotype, one male; 20 miles west Bahia de los Angeles, June 17, 1968, same collectors as holotype, three females; Agua de Higuera, June 20, 1968, same collectors as holotype, five males, seven females; Arroyo Calamajue, June 16, 1968, same collectors as holotype, seven males, five females; 1 mile south Gonzaga Bay, June 15, 1968, same collectors as holotype, two males, one female; 6 miles south Okie Landing, June 13, 1968, same collectors as holotype, five males, four females; 1 mile north Puertecitos, June 11, 1968, N. Leppla, J. Bigelow, J. Davidson, M. Cazier, two males; 12 miles northeast Punta Prieta, July 6, 1973, R. Westcott, E. Fisher, one male, one female; 10 miles north Las Arrastras, June 8, 1967, E. Sleeper, E. Fisher, one male, one female. Sonora: 2 miles north El Doctor, June 6, 1968, N. Leppla, J. Bigelow, J. Davidson, M. Cazier, 11 males, two females. United States: California: San Diego County: Palm Grove, Palm Canyon, Anza-Borrego State Park, June 5, 1970, L. (Welch)

Draper, O. Francke, M. Cazier, 27 males, 21 females; South Indian Canyon, July 9, 12, 1948, G. A. Marsh, two males.

Holotype, allotype, and paratopotypes in the collection of the American Museum of Natural History, New York; paratopotypes and paratypes in the Arizona State University collection, Tempe; four paratypes in the collection of E. M. Fisher, Riverside, California.

ETYMOLOGY: From the Latin *spectabilis*, meaning visible or remarkable in reference to its large size and contrasting black and white abdominal maculations.

ECOLOGY: All 319 paratopotypes were taken in about one hour's time as they came into a cattle watering trough and moist adjacent dirt presumably to drink (fig. 10). The specimen from San Borja was taken on moist soil on the margin of a pool of water in a river bottom. The Bahia de los Angeles specimens were also taken on moist soil on the margin of a pool of water in a river bottom. All specimens collected at Agua de Higuera were taken on moist sandy spots around a spring seepage. The paratypes from Arroyo Calamajue were taken on moist spots along a small alkaline stream. The paratypes from 1 mile south of Gonzaga Bay were taken in dry open sandy areas between hummocks formed by *Larrea tridentata* plants. Specimens from 6 miles south of Okie Landing were also taken in dry open sandy areas between hummocks of *L. tridentata* plants. The specimens from 1 mile north of Puertecitos were collected in a dry open sandy area. Specimens collected 9 miles south of San Felipe were taken in dry open sandy areas between hummocks of *L. tridentata* plants. Specimens from 13 miles north of San Felipe were taken on low dry sandy hills, which were covered with sand-burrs, mesquite, *Prosopis juliflora*, *Lophocerus* sp., and *Franseria* sp. all of which were used for shade by the flies. Paratypes from two miles north of El Doctor were taken on low sandy hills that were sparsely covered with *Atriplex* sp., *Croton* sp., and *Franseria* sp. which were being used for shade by the flies.

A few of the specimens from Palm Grove

were taken below a small waterfall on the shaded moist shore of the small stream. However, the bulk of the series was found above the waterfall on wet black or dry gray ashes which resulted from the previous burning of the upper portion of the palm grove and adjacent area. The flies seemed unaffected by, if not actually attracted to, the moist ashes and appeared to be drinking.

VARIABILITY: There is remarkably little variability considering the number of specimens and the distributional range represented in the type series. In the males there is only minor variation in the abdominal markings and all specimens have broad contrasting black and white abdominal maculations, a feature prompting the name *spectabilis*. Also, most specimens are large and robust with only four falling in the 19–20 mm. range, making this the largest North American species of *Apiocera*. In the Palm Grove series of 27 males there are five specimens in which the compound eyes are separated from the lateral ocelli on vertex by about half the width of a lateral ocellus instead of being less than half as in the rest of the series. The internal male terminalia structures show little or no variation in the 67 specimens in which the hemitergites and dististyles were spread.

RELATIONSHIPS: Superficially *spectabilis* resembles *macswaini*, *voragocolis*, *pearcei*, and *parkeri* but can be separated from all of these as given in the Key and by its larger size, more robust shape, and its white and black contrasting abdominal pattern.

Apiocera spectabilis (map 10) has been found geographically, ecologically and chronologically together with *volucra* (map 3) at Arroyo de Calamajue and 5 miles west of this locality; with *aldrichi* (map 9) at 2 miles north of El Doctor; and with *volucra* (map 3), *alleni* (map 12), and *pearcei* (map 10) at Palm Grove. *Apiocera alleni* can be separated from *spectabilis* by its broader black bands on abdominal segments three and four, by the median projection of the ninth abdominal sternite which extends posteriorly to the apical third of the lateral dististyles, even with the apex or beyond the

transverse portions of the interbasal folds (fig. 23), and by the long narrow dorsal subapical proctigeal collar. *Apiocera spectabilis* can be separated from *volucra* by lacking the long recumbent hair on the median projection of the ninth abdominal sternite, by having the inner dististyle margins widely separated in the apical third and by lacking the postmedian transverse incision in the inner dististyle margins (fig. 13). From *aldrichi*, it can be separated by lacking the apical pair of horizontal, dorsoventrally flattened falciform, sharp pointed blades protruding from beneath the dorsum of the lateral proctigeal shields and above the aedeagus (fig. 66), by its less widely open emargination in the dorsal margin of the inner interbasal folds (fig. 39), and by having the lateral parchment-like expansions of the posterior projection of the ninth abdominal sternite with evenly rounded lateral margins that overlap the dististyles laterally (fig. 13). In *aldrichi* the falciform blades are present (fig. 87), the emarginations in the inner interbasal folds are widely open and the parchment-like expansions have the lateral margins angulate and not overlapping the dististyles laterally (fig. 16). *Apiocera pearcei* can be separated from *spectabilis* by its elongate, parallel or subparallel lateral margins of the parchment-like expansions of the posterior projection of the ninth sternite which are sharply angulate posteriorly and its short blunt median projection in the posterior margin. In *spectabilis* the lateral margins of the parchment-like expansions are short, evenly rounded, not sharply angulate posteriorly and the median posterior projection is long (fig. 13). *Apiocera aldrichi* is almost as large and robust as *spectabilis*.

57. *Apiocera macswaini*, new species

Map 11

DIAGNOSIS: Small- to medium-sized, narrow, pteropleura with sparse to moderately dense tuft of long white hair in front of metathoracic spiracles; dorsocaudal angle of mesopleura with one to three white or black macrochaetae in addition to white hair; median projection of ninth sternite long, pointed

medially and extending posteriorly almost to transverse portions of interbasal folds, overlapping dististyles laterally for median one-third, posterior margin not emarginate; hind tibiae black or brown macrochaetose; compound eyes separated from lateral ocelli on vertex by more than one-half the width of a lateral ocellus; terminalia dark reddish brown; abdominal segment four with broad dark band, sternites two through four white pilose; transverse portions of interbasal folds extending into ventral opening.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex between ocelli brown pilose; antennae reddish brown, segments one and two white pruinose, pilose and macrochaetose, segment three bicolored brownish pruinose, ending apically in short acute tooth; palpi yellowish, white pruinose and pilose; posterior head surface white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about two-thirds the width of a lateral ocellus. Thorax with pronotal angles gray pruinose, brown pilose, black macrochaetose; mesonotum gray pruinose, markings light brown and gray pruinose, discal sparse short hairs brown, marginal pile white, macrochaetae black; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle with moderately dense tuft of long white hair, surface gray pruinose, both thin and thick macrochaetae black, four on each side; wings with costal margin black pilose except for mixed black and white hair at base; scutellum gray pruinose, white pilose, marginal macrochaetae black. Legs with coxae gray pruinose, white pilose, macrochaetae on middle and anterior coxae white, black and white mixed on posterior coxae; femora reddish brown, gray pruinose, anterior femora white pilose, macrochaetae on outer margin black, middle and hind femora black and white pilose, black macrochaetose; tibiae reddish brown, anterior and middle tibiae white pilose, black macrochaetose, posterior tibiae brown and white pilose, black macrochaetose; tarsi reddish brown, anterior and middle tarsi brown and white pilose, black macrochaetose, posterior tarsi brown pilose, black macrochaetose; tarsal pulvilli broad,

two-thirds as long as claws. Abdomen gray pruinose, brown maculose, brown and white pilose; segment one light tan pruinose basally, gray pruinose in apical half, long white pilose throughout, especially dense laterally, subapical row of macrochaetae black; segment two with narrow median transverse brown band expanded medially and dorso-laterally, extending to basal margin medially interrupting gray basal vitta, not interrupting wide apical white transverse vitta, pile long and white except for few subapical brown hairs; segment three with wide median dark brown transverse band not reaching apical margin, basal margin narrowing from midlateral to middorsal point reaching basal margin of segment, wide lateral gray pruinose basal areas white pilose, dark median area brown pilose, narrow apical margin gray pruinose; segment three similar to segment two except that maculation is lighter brown and has irregular brown and gray pruinosity especially in apical half; segments five through seven uniform white pruinose, sparsely white pilose; segments one through four gray pruinose, white pilose ventrally; segments five through seven white pruinose and pilose ventrally. Terminalia: Exterior. Dark reddish brown, without pruinosity; hemitergites sparsely black pilose, apices bluntly rounded; dististyles sparsely black pilose, apices bluntly rounded and with a few strong black macrochaetae, ventral area between dististyles widely open from apex of median projection of ninth sternite to near apical convergence of dististyles, inner margins without postmedian incision; ventral extension of outer interbasal fold prominently extending into opening between dististyles at about apical third of terminalia; median projection of ninth sternite flattened, mostly bare in lateral membranous extensions, median inverted narrow V-shaped area sparsely irregularly clothed with black pile, lateral membranous extensions short, margins strongly rounded from base to base of posterior median projection, not angulate basally, posterior margin gradually tapering to long acute median point reaching base of inner projections of interbasal folds, lateral margins overlapping dististyles at widest point only. Terminalia:

Interior. Hemitergites with sparse black pile along dorsal apical and subapical margin, four small black hairs near inner base of locking fold, tuberculate area round, extending from inner base of locking fold almost to dorsal margin, locking fold strongly angulate from surface, semitransparent, lower margin an inward extension of dorsal margin, bent strongly inward and then downward from apex, curving downward to about ventral third of hemitergite, bluntly rounded at lowest basal third then curved upward and posteriorly to surface connection at about midvertical of hemitergite, margin not extending below ventral hemitergite margin; proctiger gradually constricted near basal expansion in membranous area, strongly constricted near apical third posterior to shieldlike lateral extensions that project prominently outward and downward, collar-like round area extending between dorsal attachment of shield margins and dorsal apex of proctiger, dorsal apex extending posteriorly slightly beyond attachment of two sickle-shaped arms that extend ventrally on each side of aedeagus; claspettes straight, slightly angulate inward toward apex, concave internally, upper margin in apical half behind tip narrowly membranous, upper margin sparsely golden pilose subapically, apical margin of each claspette with bluntly rounded projection over long subapical lobes that curve downward and inward, meeting below the aedeagus, inner margins concave, sparsely golden pilose; inner interbasal folds deeply and broadly emarginate apically, margins sparsely golden pilose, outer interbasal folds broadly truncate apically, ventral angles rounded and extended into opening between dististyles. Length 20 mm.; mesonotal width 4.5 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics. The upper front of head and vertex are tan pruinose, vertex between ocelli brown pilose. Mesonotum gray pruinose, markings tan pruinose, marginal and submarginal macrochaetae black. Legs reddish brown, femora gray pruinose, white pilose and macrochaetose; tibiae white pilose, black macrochaetose.

tose; tarsi brown pilose, black macrochaetose; pulvilli broad, two-thirds the length of the claws. Abdominal segments two and three with isolated dorsolateral dark spots. Length 17 mm.; mesonotal width 4.5 mm.

TYPE MATERIAL: Holotype male, allotype female, 40 male and 11 female paratopotypes collected at Antelope Springs, Inyo County, California, July 17, 1953 by the late Dr. J. W. MacSwain. The type locality is 8 miles southwest of Deep Springs, Inyo County, California, a locality that is on most maps. Additional paratopotypes are as follows: Thirty-seven males, 40 females, June 29, 30 and July 1, 1961, J. Powell, G. W. Frankie, M. E. Irwin, G. I. Stage, J. S. Buckett, D. R. Miller, J. K. Drew; nine males, 23 females, June 19, 22, 1960 and July 9, 1966, H. K. Court; four males, July 10, 1961, P. M. Marsh; one male, one female, July 11, 1967, R. O. Schuster; one female, July 9, 1968, D. S. Horning, Jr.; one female, August 24, 1960, P. D. Hurd.

PARATYPES: California: Inyo County: Deep Springs, July 17, 1953, J. T. Brooks, W. D. McLellan, D. D. Linsdale, H. Washburn, 26 males, 15 females, July 16, 1953, E. I. Schlinger, five females, August 13, 1969, R. M. Bohart, two females, July 4, 11, 1976, James O'Grady, 10 males, six females. One male, not included in the type series, was collected at Hallelujah Junction, Lassen County, California, July 11, 1961 by R. M. Bohart. It appears to be structurally the same as *macswaini*, but its locality is widely disjunct from the type locality and it is represented by a single specimen.

Holotype male, allotype female deposited in the collection of the California Academy of Sciences, San Francisco; on an indefinite loan from the Essig Museum of Entomology, University of California, Berkeley. Paratopotypes and paratypes deposited as follows: Essig Museum, University of California, Berkeley; Department of Entomology, University of California, Davis and Los Angeles; California Academy of Sciences, San Francisco; the American Museum of Natural History, New York; Arizona State University, Tempe; collection of James J. O'Grady, Tucson, Arizona.

ETYMOLOGY: The species is named in honor of the late Dr. J. W. MacSwain who supplied material and information that contributed greatly to this project.

ECOLOGY: On November 19, 1962 I received the following information (*in litt.*) from Dr. J. W. MacSwain regarding the type series he collected at Antelope Springs. "The collection you refer to was taken under unusual circumstances. On the morning of the collection I discovered the *Apiocera* sitting on flat rocky ground in moderate numbers. By stalking them I obtained three in more than one hour's work. Later I discovered a 2-foot high bush near the Spring where several kinds of insects had gathered both on the stems and the ground beneath. Among these, sitting in both locations were a number of *Apiocera*. In contrast to their usual swift flight when disturbed, these specimens remained stationary when approached. With the exception of the three caught earlier, the remainder of the series was picked up by the fingers from their perches on the bush or ground under it." To my knowledge this collecting technique has not been duplicated although several people have tried, including the author and James O'Grady of Tucson.

In view of the paucity of information on the feeding habits of adult *Apiocera* it would appear appropriate to record here the occurrence of pollinia, pollen-carrying structures of the genus *Asclepias* species (milkweed), on the tarsi of this species. One male specimen collected at the Deep Springs had two pollinia on the anterior tarsi and one on a posterior tarsus, all of which were securely attached, thus indicating that this male visited a flower of a milkweed. Whether or not this was for the purpose of feeding is unknown but it is a possibility.

VARIABILITY: Comparatively little variability was found in the major characteristics in 234 specimens of this species. In all but a few male specimens the gray pruinose median transverse vitta on the first abdominal segment is interrupted medially by a posterior median extension of the basal brown vitta. In most of the dissected males, 20 specimens, the proctiger has a collar-like area behind the apex and in front of the ventral

shield. In a few, the lateral edges of the shield extend up to the apex or near the apex of the proctiger. The posterior margin of the outer interbasal fold is always expanded and protrudes into the ventral opening between the dististyles. The pteropleura usually has an extensive tuft of long white hair that extends dorsally and anteriorly from the area immediately in front of the metathoracic spiracles. The shallowly rounded lateral membranous margins of the median projection of the ninth sternite vary somewhat, but they are never angulate basally and never straight and subparallel medially. The degree to which they overlap the dististyles laterally varies from almost no overlap to overlapping in the middle third, never for almost their entire length.

RELATIONSHIPS: *Apiocera macswaini* appears to be most closely related to *exta* and has been confused with that Panamint Mountain species in a number of collections. It also exhibits superficial affinities with *parkeri* and *arena*, but can be separated from all three species as follows: Both *macswaini* and *exta* have the lateral ocelli on the vertex separated from each other by the width or less than the width of an ocellus and the costal wing vein is predominantly or entirely black pilose, may be white pilose basally. In *parkeri* and *arena*, the lateral ocelli are separated from each other by one to one and one-half to two times the width of an ocellus and the costal wing vein is predominantly or entirely white pilose. *Apiocera macswaini* can be separated from *exta* by its broadly expanded posterior margin on the outer interbasal fold, the ventral point of which extends into the ventral opening between the dististyles. Also, the median projection of the ninth sternite is shorter and narrower and less membranous than in *exta*.

Apiocera macswaini (map 11) occurs sympatrically with *haruspex atrifasciata* (map 4) at the type locality where two males of the latter were collected. However, the two species are only distantly related as *haruspex atrifasciata* has the dististyles closed in the apical third (see fig. 14) and both the pteropleura and the dorsocaudal angle of the mesopleura are bare. In *macswaini* the dis-

tistyles are open in the apical third (see fig. 13) and the pteropleura and dorsocaudal angle of the mesopleura are pilose. There are many other differences.

58. *Apiocera voragocolis*, new species

Figure 67; Map 9

DIAGNOSIS: Small-sized, narrow; pteropleura with long hair anterior to the metathoracic spiracles; dorsocaudal angle of mesopleura pilose and macrochaetose; median projection of ninth sternite not extending posteriorly to transverse portions of interbasal folds, overlapping dististyles at widest portion; posterior tibiae black macrochaetose; compound eyes separated from lateral ocelli on vertex by less than one-half the width of a lateral ocellus; terminalia brown, without pruinosity; median projection of ninth sternite with long acutely pointed posterior median projection; posterior femora and tibiae without tomentose covering on posterior margins.

DESCRIPTION: Male: Head with front white (greasy) pruinose and pilose below median ocellus, vertex gray pruinose, brown pilose between ocelli; antennal segments one and two reddish brown, white pruinose, pilose and macrochaetose, segment three light brown basally, dark brown apically, strongly pruinose throughout, ending in short acute tooth; palpi dark basally, yellowish apically, white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by less than one-half the width of a lateral ocellus; posterior head margin white pruinose, pilose and macrochaetose. Thorax with pronotal angles gray pruinose, brown pilose, black macrochaetose; mesonotum gray pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile white, macrochaetae black; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle white pilose, with two black macrochaetae; wings with costal margin black pilose throughout; scutellum gray pruinose, brown pilose, marginal macrochaetae black. Legs with coxae gray pruinose, white pilose, both black and white macrochaetose; femora piceous, anterior

and middle femora gray pruinose, white pilose, black macrochaetose, posterior femora gray pruinose, brown pilose, black macrochaetose; tibiae reddish brown, anterior and middle tibiae white and brown pilose, black macrochaetose, posterior tibiae brown pilose, black macrochaetose; tarsi yellowish brown, anterior and middle tarsi brown and white pilose, black macrochaetose, posterior tarsi brown pilose, black macrochaetose; tarsal pulvilli broad, two-thirds as long as claws. Abdomen with segment one gray pruinose dorsolaterally, brown pruinose medially, white pilose in basal two-thirds, brown pilose in apical third, subapical macrochaetae black; segment two with dorsolateral basal and apical gray pruinose spots reaching margins, not connected medially, pile white basally, brown apically, median subtriangular area and lateral median areas black; segments three and four with dorsolateral basal gray pruinose spots reaching basal margin, apical margin narrowly gray pruinose, slightly widened dorsolaterally on segment three, wide median fascia dark brown or black, pile white basally, brown in apical three-quarters; segments five through seven white and gray pruinose, without dark maculations, pile white basally, brown apically; dark dorsal fasciae reaching pleural suture on segments one through four, segment five with small dark median dark area along pleural suture; sternites dark reddish brown, smooth with faint gray pruinosity, sparsely white pilose. Terminalia: Exterior. Reddish brown throughout, finely brown pruinose, sparsely black pilose; hemitergites with dorsal margin irregular in apical third, posterior margin with shallow, obtuse subapical notch, apex evenly rounded, slightly extended, ventral margin shallowly rounded to base; dististyles slightly enlarged subapically, evenly, obtusely rounded at apex, ventral margin without postmedian incision, open ventrally from median projection on ninth sternite to subapical enlargement; median projection of ninth sternite flat, membranous basal area overlapping dististyles laterally at median widest point, lateral margins obtusely angulate inward and posteriorly at middle, narrowing gradually into long acute posterior

median point, median point reaching base of inner projections of interbasal folds, median point equal distance from lateral angulation as from base to angulation, median area and base of point sparsely black pilose. Terminalia: Interior. Hemitergites with sparse black pile along dorsal margin, short inner ridge submarginally posterior to shallowly protruding apex, larger subparallel ridge extending inward and at right angles to surface from bottom of subapical notch, forming outer margin of locking fold which extends basally to middle of apical third, basal margin of locking fold without tuft of short erect black hair, locking fold surface smooth and irregular, lower margin not extending below ventral hemitergite margin, tuberculate area narrow extending diagonally basally and dorsally from inner basal attachment of locking fold almost to dorsal margin; proctiger narrow, margins gradually constricted toward base, widened about middle, strongly constricted apically to collar formed by posterior lateral projections extending dorsally toward apex, lateral projections extending downward and slightly posteriorly, semitransparent, apex narrow, bluntly rounded, long bowed narrow sharply pointed ventral subapical projections extending downward on each side of aedeagus (fig. 67); claspettes straight from base to bluntly rounded apex, slightly converging inward from base to apex, dorsal edge sparsely golden pilose in median half, nonmembranous, subapical ventral lobes long, flattened, wide basally, narrowing gradually toward tips, curved downward and inward, meeting above aedeagus, sparsely clothed with short golden pile (fig. 67); inner interbasal fold deeply roundly emarginate apically, surface thickened anterior to emargination, inner edge sparsely clothed with short golden pile, outer interbasal fold expanded ventrally at apex, ventral angle of expansion projecting prominently into ventral opening between dististyles slightly postmedially to length of dististyles. Length 16.4 mm.; mesonotal width 3.3 mm.

FEMALE: Unknown.

TYPE MATERIAL: Holotype male collected at Indian Garden, Grand Canyon National

Park, Coconino County, Arizona, July 12, 1948 by M. Cazier, elevation 3876 feet. One male paratype collected at the confluence between the Little Colorado River and the main Colorado River on the floor of the Grand Canyon, Coconino County, Arizona, June 25, 1970 by Beverly Chilton.

Holotype male in the collection of the American Museum of Natural History, New York. The paratype is in the collection of Arizona State University, Tempe.

ETYMOLOGY: From the Latin *vorago*, meaning chasm or abyss and *colo*, meaning dwell which is descriptive of the habitat deep within the chasm of the Grand Canyon of the Colorado River.

ECOLOGY: The holotype was collected in the shade of trees on damp soil in the Indian Garden rest-stop on the trail between the south rim and Phantom Ranch in the bottom of the canyon. This location is about 3000 feet below the south rim. The paratype was taken on an open sand dune back from the beach along the edge of the Colorado River.

VARIABILITY: There is little variability between the two specimens except in size. The paratype is slightly larger and more robust being 18.6 mm. in length and the mesonotal width is 4 mm. Also, the paratype is less greasy than the holotype and the white maculations are therefore more evident. Only the terminalia of the holotype was dissected.

RELATIONSHIPS: From a distributional standpoint *voragocolis* (map 9) may be found eventually associated with *parahydra* (map 13), since they both occur on or near the Little Colorado River, but about 100 miles apart. However, in *voragocolis* the terminalia are open ventrally and in *parahydra* they are closed. From *auripilosa* (map 11), with which it occurs sympatrically at the confluence between the Little Colorado and the main Colorado rivers, *voragocolis* can be separated by its narrowly separated compound eyes from the lateral ocelli on the vertex and by having white instead of golden abdominal pile on sternites two through four. For additional comparisons, see the discussion under *auripilosa*. From *mortensoni* (map 13), which occurs in the same general region but not down in the canyon, *vorago-*

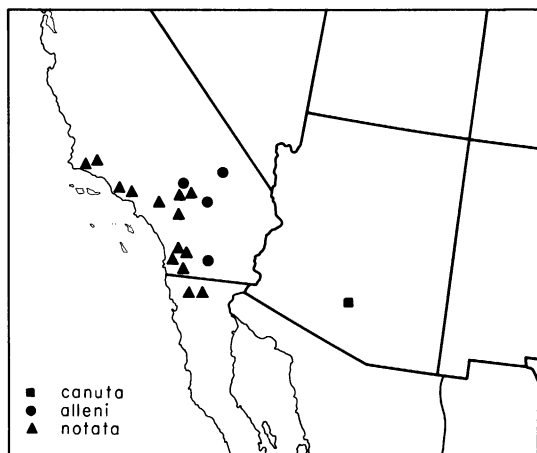
colis can be separated by having the area between the dististyles open instead of closed and by having short rather than long black pile on the median projection of the ninth abdominal sternite. For additional comparisons see the discussion under *mortensoni*. From *spectabilis* (map 10), which is widely disjunct in distribution, *voragocolis* can be separated as given in the Key and under the discussion of *spectabilis*.

59. *Apiocera canuta*, new species

Figure 94; Map 12

DIAGNOSIS: Medium-sized, narrow; pteropleura with sparse tuft of long white hair in front of metathoracic spiracles; dorsocaudal angle of mesopleura with one to three (paratopotype) black macrochaetae in addition to sparse white hair; median projection of ninth sternite extending to transverse portions of interbasal folds, overlapping dististyles laterally in middle third, clothed medially with long white pile; hind tibiae predominantly black or brown macrochaetose; compound eyes separated from lateral ocelli on vertex by less than one-half the width of a lateral ocellus; terminalia densely white pruinose; hind femoral macrochaetae primarily white; abdominal segments five through seven with dorsal short hairs white.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex between ocelli brown pilose; antennal segments one and two white pruinose, pilose and macrochaetose, segment three bare, primarily black; posterior head surface white pruinose, pilose and macrochaetose; palpi white pruinose and pilose. Thorax with pronotal angles black macrochaetose, brown pilose, gray pruinose; mesonotum (badly rubbed) brown pilose, discal markings brown pruinose, lateral margins gray pruinose, marginal and posterior discal macrochaetae black and white mixed; mesopleura white pruinose and pilose; wings with costal margin white pilose from base to apical third; scutellum gray pruinose, white pilose, posterior margin black macrochaetose. Legs with femoral ground color piceous, tibiae and tarsi reddish brown; coxae white pruinose, pilose and



MAP 12. Distributions of *Apiocera* sp.: *A. canuta*, *alleni*, *notata*.

macrochaetose; femora with dense white pruinosity, white pilose and macrochaetose; tibiae on anterior and middle legs white pilose and macrochaetose, hind tibiae brown and white pilose, macrochaetae primarily dark; tarsi on front and middle legs white and brown pilose, brown macrochaetose, hind tarsi brown pilose and macrochaetose; pulvilli broad, about two-thirds as long as claws. Abdomen primarily white pilose and pruinose except for brown pile on dorsal dark markings on segments three and four; segment one with narrow transverse basal brown pruinose band, apical two-thirds gray pruinose, subapical row of macrochaetae black; segment two with basal transverse dorsal brown pruinose band grading into dorsal median black transverse band, black band expanded medially narrowly reaching posterior margin; segments three and four with wide transverse dorsal black bands expanded medially reaching basal margins, not reaching apical margins; segments two and three with dark lateral spots; segment four with lateral dark marking broadly connected with dorsal transverse dark band. Terminalia: Exterior. Hemitergites densely white pruinose except near base, upper surface with short sparse brown pile, bottom edge white pilose; dististyles densely white pruinose except near base, upper basal area

brown pilose extending to apical two-thirds, remainder sparsely white pilose; median projection of ninth sternite reddish brown, extending almost to apex of transverse projections of interbasal folds, overlapping dististyles laterally for about basal half, lateral margins evenly rounded from base to near acute median tip, median surface area sparsely white pilose. Terminalia: Interior. Hemitergites without tufts of black pile, row of black pile along dorsal margin above locking fold; subapical locking fold heavily sclerotized, margin even, not wrinkled, extending inward at about a 45-degree angle from surface; dorsal tuberculate area extending from about middle posteriorly to just beyond angle of upper margin; proctiger short and wide, lateral wings extending downward and toward base, apical arms extending slightly posteriorly and prominently downward and enclosing aedeagus (fig. 94); claspettes straight, enlarged at base and apex, extending diagonally inward, sparsely clothed with long golden pile, inner subapical lobes long thin and irregularly curved downward, moderately and uniformly clothed with long golden pile; interbasal folds extending posteriorly to about middle of dististyles, deeply and roundly excavated apically, visible in ventral opening, apical one-quarter of dististyles sparsely clothed with black pile. Length 19 mm.; mesonotal width 4.5 mm.

FEMALE: Unknown.

TYPE MATERIAL: Holotype male and one paratopotype male collected 10 miles south of Toltec, Pinal County, Arizona, June 21, 1953 by T. R. Haig.

Holotype in the collection of the American Museum of Natural History, New York. Paratopotype in the Arizona State University collection, Tempe.

ETYMOLOGY: From the Latin *canuta*, meaning white-haired which characterizes this light-colored, white pilose species.

ECOLOGY: No information available.

VARIABILITY AND RELATIONSHIPS: There is little or no variability between the two specimens. *Apiocera canuta* (map 12) appears to be most closely related to *pruinosa* (map 3), but can be separated from it as discussed under that species. The male termi-

nalía were opened only in the holotype. The species is allopatric with all others, at least at the present time.

60. *Apiocera pruinosa*, new species

Figures 19, 95; Map 3

DIAGNOSIS: Medium-sized, narrow; pteropleura with moderately dense tuft of long white hair; dorsocaudal angle of mesopleura with two white macrochaetae in addition to long white hair; median projection of ninth sternite not extending to transverse portions of interbasal folds, overlapping dististyles laterally for basal two-thirds (fig. 19); hind tibiae predominantly black or brown macrochaetose; compound eyes separated from lateral ocelli on vertex by less than one-half the width of a lateral ocellus; terminalia densely white pruinose; hind femoral macrochaetae primarily white; abdominal segments five through seven with dorsal short hairs brown; median projection of ninth sternite piceous, primarily black or brown pilose.

DESCRIPTION: Male: Head with front white pruinose and pilose, vertex between ocelli brown pilose; antennal segments one and two white pruinose, macrochaetose and pilose, segment three bare, primarily black; posterior head surface white pilose, pruinose and macrochaetose; palpi white pruinose and pilose. Thorax with pronotal angles black macrochaetose, brown pilose, tan pruinose; mesonotum brown pilose, markings brown pruinose, light areas tan pruinose, marginal and posterior discal macrochaetae mixed black and white; mesopleura white pruinose and pilose; wings with costal margin white pilose from base to near apex; scutellum gray to tan pruinose, brown pilose, posterior margin black macrochaetose. Legs with ground color piceous; coxae white pruinose, pilose and macrochaetose; femora with dense white pruinosity, entirely or primarily white macrochaetose, pile brown and white mixed; tibiae on anterior and middle legs with dense white pruinosity, macrochaetae white, hind tibiae sparsely white pruinose, macrochaetae predominantly dark; tarsi on front and middle legs white and brown pilose, brown

macrochaetose, hind tarsi brown pilose and macrochaetose; pulvilli broad, about two-thirds as long as claws. Abdomen white pilose and pruinose except for brown pile on dorsal dark markings on segments one to four and short brown hair on dorsum of segments five through seven; segment one with subapical margin black macrochaetose, mid-dorsum with triangular brown pruinose marking; segment two with basal transverse dorsal brown pruinose band grading into dorsal median black transverse band, black band expanded medially narrowly reaching posterior margin; segments three and four with wide transverse dorsal black bands expanded medially reaching basal margins, not reaching apical margins; segments two through four with dark lateral indistinct marks. Terminalia: Exterior. Hemitergites densely white pruinose except near base, upper surface with short sparse brown pile, bottom edge with row of white pile; dististyles densely white pruinose except near base, upper surface and base with short sparse brown pile, lower margin white pilose; median projection of ninth sternite piceous, not extending to transverse projections of interbasal folds, overlapping dististyles laterally for basal two-thirds, lateral margins evenly rounded from base to acute median apical tip (fig. 19), median surface area sparsely clothed with long black and white pile intermixed. Terminalia: Interior. Hemitergites without dense tufts of black pile; subapical locking fold heavily sclerotized, margin even, not wrinkled, extending outward at about a 45-degree angle from surface; dorsal tuberculate area extending narrowly from near apex, along base of locking fold and diagonally to top margin, encompassing an area of about one-third of dorsal one-half of surface; proctiger with lateral wings extending downward and toward base, apical arms extending slightly posteriorly and prominently downward enclosing the aedeagus (fig. 95); claspettes straight, enlarged at base and apex, extending diagonally inward, sparsely clothed with long golden pile, inner subapical lobes long thin and irregularly curved downward, moderately and uniformly clothed with long golden pile; in-

terbasal folds extending posteriorly to about middle of dististyles, deeply and roundly excavated apically, barely visible in ventral opening. Length 18 mm.; mesonotal width 4.5 mm.

FEMALE: Unknown.

TYPE MATERIAL: Holotype male and one paratopotype male collected at Golden Shores near Topock, Mohave County, Arizona, May 30, 1969, by J. Bigelow and M. Cazier.

Holotype in the collection of the American Museum of Natural History, New York. Paratopotype in the Arizona State University collection, Tempe.

ETYMOLOGY: From the Latin *pruinosa*, meaning hoar frost which generally describes the appearance of the hemitergites and dististyles which are densely white pruinose.

ECOLOGY: Specimens of both *pruinosa* and *pearcei* were collected as they came into an artificially wet sandy area around an irrigation faucet in a new real estate development. They appeared to be drinking as they held their fleshy mouthparts on the damp sand.

VARIABILITY: There is little variability between the two specimens except in the abdominal markings. In the paratopotype the dorsal dark transverse band on segment four is broadly connected to the lateral dark spot and segments five through seven have irregular small brownish dorsolateral spots. Only the holotype male was dissected.

RELATIONSHIPS: *Apiocera pruinosa* appears to be most closely related to *canuta*, but can be separated from it by having the short dorsal hairs on abdominal segments five through seven dark instead of white. The median projection of the ninth sternite is piceous and primarily dark pilose, whereas in *canuta* the projection is reddish brown and primarily or entirely white pilose. In *pruinosa* (fig. 95) the proctiger is elongate and narrow, whereas in *canuta* it is short and wide (fig. 94). The latter species is known only from 10 miles south of Toltec, Pinal County, Arizona (map 12). From *pearcei* (map 10), with which it occurs sympatrically at Golden Shores, *pruinosa* (map 3) is abundantly distinct in numerous characters. In

pearcei the eyes are more widely separated, the terminalia are not densely white pruinose, the median projection of the ninth sternite is flat with lateral margins angulate apically, the mesonotal setae are all black, and the proctiger has a moderately long subapical dorsal collar. In *pruinosa* the compound eyes are almost touching the lateral ocelli on the vertex, the terminalia exterior is densely white pruinose, median projection of the ninth sternite has the lateral expansions tumid and the margins are gradually rounded apically, the mesonotal macrochaetae are mixed black and white, and there is no subapical dorsal collar on the proctiger.

61. *Apiocera davidsonorum*, new species

Figures 92, 110, Map 7

DIAGNOSIS: Medium-sized, narrow; pteropleura with sparse tuft of long white hair in front of metathoracic spiracles; dorsocaudal angle of mesopleura with one to three black macrochaetae in addition to brownish hairs; median projection of ninth sternite not extending posteriorly to transverse portions of interbasal folds, overlapping dististyles laterally for median half; hind tibiae black or brown macrochaetose; compound eyes separated from lateral ocelli on vertex by about the width of a lateral ocellus; terminalia white pruinose, dististyles primarily white pilose with apical hairs white or brown; abdominal segments two through four with dark dorsal areas broadly interrupted by two longitudinal dorsolateral white vittae (fig. 110).

DESCRIPTION: Male: Head with front white pruinose, slightly yellowish in ocelli area, white pilose almost to median ocellus, brown pilose from below median ocellus dorsally over and behind vertex; antennal segments one and two white pruinose, pilose and macrochaetose, segment three bicolored, white pruinose basally, brown pruinose apically, ending in short acute tooth; palpi dark basally, pale yellowish apically, white pruinose, pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about the width of a lateral ocellus; posterior head margin white prui-

nose, pilose and macrochaetose. Thorax with midpronotal area white pruinose, pilose and macrochaetose, lateral angles white pruinose, sparsely brown pilose, black macrochaetose; mesonotum white pruinose, markings light and dark brown pruinose, discal sparse short hairs brown, marginal and submarginal pile brown and white mixed, macrochaetae black; mesopleura white pruinose and pilose, dorsocaudal angle white pilose, black macrochaetose, lower epimeral area anterior to metathoracic spiracles with long white hairs; wings with costal margin white pilose from base to near apex; scutellum white pruinose, white and brown pilose, marginal macrochaetae black. Legs with coxae white pruinose, pilose and macrochaetose; femora black, densely white pruinose, anterior and middle pair white pilose, black macrochaetose, posterior pair brown and white pilose, black macrochaetose; tibiae black, sparsely white pruinose, anterior and middle pair brown and white pilose, black macrochaetose, posterior pair brown pilose, black macrochaetose; tarsi piceous, brown pilose, black macrochaetose; tarsal pulvilli moderately broad, two-thirds as long as claws. Abdomen with segment one light brown pruinose medially from basal to apical margins, white pruinose laterally, pile white throughout, subapical row of macrochaetae black; segments two through four with median light brown spot extending from basal margin to near apical margin, widely separated from dorsolateral median darker oblong spots, longitudinal dorsolateral vittae and apical margin white pruinose, pile white in basal three-quarters including dark areas, sparse and black in apical one-quarter; segments five through seven irregularly white pruinose, segments five and six with thin middorsal longitudinal broken line, pile brown and white mixed; pleural areas white pruinose and pilose, segments two through four and the base of segment five with faint brown longitudinal elongate bands along suture, not connected to dorsolateral dark median spots (fig. 110); sternites white pruinose and pilose. Terminalia: Exterior. Densely pruinose, hemitergites white pruinose medially from apex to near base, slightly darker

along dorsal margin, yellowish in ventral half, dististyles densely white pruinose throughout; hemitergites with dorsal margin slightly angulate at apical quarter, apex evenly rounded into shallow indentation at junction with locking fold, ventral margin shallowly rounded from base to subapical indentation, surface sparsely black pilose except for few white apical and ventral marginal hairs; dististyles evenly rounded apically, ventral margin without median or postmedian incision, open ventrally from median projection of ninth sternite to near apex, surface sparsely black pilose basally and along dorsal half to apical three-quarters, lower margin and apical one-quarter white pilose except for few black hairs along dorsal margin anterior to apex; median projection of ninth sternite membranous laterally, margins evenly rounded from base to near apex, narrowly overlapping dististyles laterally at widest point, apex acutely pointed, not extending posteriorly to transverse projections of interbasal folds, black pilose at base and in anterior median area, sparsely white pilose laterally and apically. Terminalia: Interior. Hemitergites with sparse black pile submarginally on posterior declivity of dorsal margin, locking fold sharply elevated above hemitergite surface, margin sinuous posteriorly to junction with surface, tuberculate area elongate extending diagonally upward and anteriorly from locking fold junction almost to dorsal margin; proctiger widest medially, narrowed to expanded base in membranous area, sharply narrowed posteriorly to lateral expanded arms, arms projecting outward, downward and slightly anteriorly as a shield, apical tubular collar extending posteriorly, divided medially at apex with lateral arms extending downward and slightly posteriorly on each side of aedeagus (fig. 92); claspettes straight, evenly rounded apically, concave internally from base to near apex, inner margin sparsely golden pilose, subapical ventral lobes long, curved and extending inward to aedeagus, moderately brown pilose throughout; inner interbasal fold deeply emarginate apically in dorsal margin, outer fold expanded apically, narrowly extending into ventral opening be-

tween dististyles. Length 18.7 mm.; mesonotal width 4.2 mm.

FEMALE: Unknown.

TYPE MATERIAL: Holotype male and two male paratopotypes collected at San Juan, Baja California Sur, Mexico, June 29, 1968 by N. Leppla, J. Davidson, S. Bigelow, M. Bentzien, W. Fox, S. Williams, and M. Caizer.

Holotype male in the collection of the American Museum of Natural History, New York. Paratopotypes in the collection of Arizona State University, Tempe.

ETYMOLOGY: The species is named in honor of Jean and Jerry Davidson who assisted the author in gathering much material used in this study.

ECOLOGY: The specimens were collected on moist, sandy soil at a spring seepage as they were evidently drinking.

VARIABILITY: Aside from one paratopotype that has most of the pruinosity rubbed off of abdominal segments two through four, there is little variability in the three specimens. All three males had their terminalia opened for study but no important variation was found.

RELATIONSHIPS: *Apiocera davidsonorum* appears to be most closely related to *caloris* but can be readily separated from it by having the abdominal dark maculations on segments two through four widely interrupted dorsolaterally by longitudinal white pruinose vittae (fig. 110), by having white or black pile instead of short black macrochaetae on the apex of the dististyles, by having dense white pruinosity on the terminalia, and by the evenly rounded instead of parallel membranous margins on the median projection of the ninth sternite.

Apiocera davidsonorum (map 7) occurs geographically, ecologically and chronologically together with *bibula* (map 10) and *horticolis* (map 6) at San Juan, but is only distantly related to either one. It can be easily separated from both *bibula* and *horticolis* by lacking the long recumbent pile on the median projection of the ninth abdominal sternite, by having the inner dististyle margins widely separated in the apical third and without the postmedian transverse incision (see

fig. 13), the inner interbasal folds have a single subapical deep emargination in the dorsal margin (see fig. 39), and the ventral subapical claspette lobes are long and sinuous. In *bibula* and *horticolis* the median projection of the ninth abdominal sternite has long recumbent pile extending from the base to the postmedian transverse incisions in the inner dististyle margins which are apposed in the apical third (see fig. 14), the inner interbasal folds are biemarginate apically and subapically (see fig. 38), and the ventral subapical claspette lobes are short or medium in length and straight.

62. *Apiocera ammophila ammophila*,
new subspecies

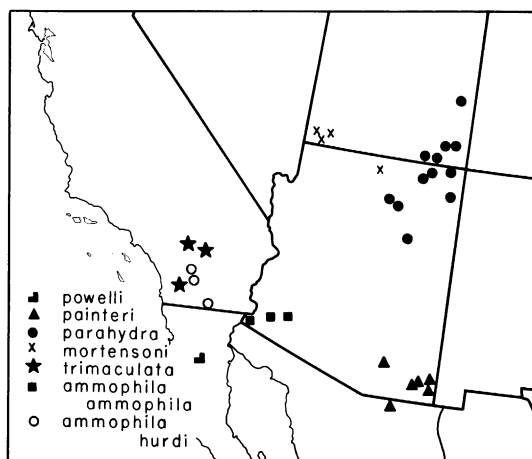
Figure 109; Map 13

DIAGNOSIS: Medium to small-sized, narrow; pteropleura with sparse to medium tuft of long white hair in front of metathoracic spiracles; dorsocaudal angle of mesopleura with one to four white or black macrochaetae in addition to long white pile; median projection of ninth sternite, exclusive of pile, not extending posteriorly to transverse portions of interbasal folds, membranous lateral margins short, evenly rounded from base to near apex, gradually converging to posterior median point, overlapping dististyles laterally in apical third, hemitergites and dististyles gray pruinose, primarily or entirely white pilose, piceous in basal two-thirds, dististyles with terminal black pile and short black macrochaetae; abdominal segments two through four with middorsal dark transverse uninterrupted bands, expanded medially (fig. 109); mesonotum gray pruinose except for darker markings; compound eyes separated from lateral ocelli on vertex by the width or more than the width of a lateral ocellus.

DESCRIPTION: Male: Head with front white pruinose and pilose below median ocellus, white pruinose and sparsely brown pilose between and behind ocelli; antennal segments one and two piceous, white pruinose, pilose and macrochaetose, segment three dark, sparsely white pruinose basally, sparsely golden pruinose apically, ending in short acute tooth; palpi dark basally, pale

yellowish apically, white pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about one and one-quarter times the diameter of a lateral ocellus; posterior head margin white pruinose, pilose and macrochaetose. Thorax with midpronotum white pruinose, pilose and macrochaetose, lateral angles white pruinose, white and brown pilose, black macrochaetose; mesonotum gray pruinose, markings brown pruinose, discal sparse short hairs brown, marginal and submarginal pile white, macrochaetae black and white, primarily black; mesopleura gray pruinose, sparsely white pilose, dorsocaudal angle white pruinose and pilose, with four black macrochaetae; scutellum gray pruinose, white pilose, black and white macrochaetose. Legs with coxae white pruinose, pilose and macrochaetose; femora black, sparsely white pruinose, white pilose and macrochaetose; anterior tibiae black, middle and posterior pair reddish brown basally, black to piceous apically, anterior and middle pairs sparsely white pruinose, pilose and macrochaetose, posterior pair sparsely white pruinose, white pilose, black and white macrochaetose; anterior tarsi piceous, white pilose, black macrochaetose, middle tarsi with first segment reddish brown, remainder black, white and brown pilose, black macrochaetose, posterior tarsi with segments one through three reddish brown, four and five dark, brown and white pilose, black macrochaetose; tarsal pulvilli moderately broad, two-thirds as long as claws. Abdomen with segment one brown pruinose basally, expanded medially reaching apical margin, large dorsolateral gray pruinose areas reaching apical margin, white pilose throughout, subapical row of macrochaetae black; segment two sparsely gray pruinose in basal third, interrupted medially by extension of median black transverse vitta, narrow black vitta expanded medially, reaching both basal and apical margins, apical third dorsolaterally white pruinose to apical margin, white pilose throughout (fig. 109); segment three similar to segment two except that white pruinose areas are narrower and the expanded median portion of the black vitta is brown pilose; segment four is

black or brown in apical half and reaches the basal margin medially, dorsolateral white pruinose areas reaching middle laterally, white pilose except for middorsal dark areas which are brown pilose (fig. 109); segments five through seven black, sparsely white pruinose, sparsely white pilose; pleural areas gray pruinose, white pilose, segments two through four with marginal or submarginal elongate dark areas not connected to dorsal maculations; sternites gray pruinose, white pilose. Terminalia: Exterior. Piceous basally, reddish brown apically, white pruinose especially in basal two-thirds; hemitergites sparsely black pilose except for white pilose ventral margin, dorsal margin shallowly angulate at apical one-quarter, shallowly rounded to apex, posterior margin evenly rounded from apex to ventral margin which is evenly rounded to base; dististyles white pilose except at extreme bases and apices, base sparsely black pilose, apex black pilose, sparsely black macrochaetose, ventral margin without postmedian incision, open ventrally between dististyles from median projection of ninth abdominal sternite to near apices; median projection of ninth abdominal sternite flat, overlapping dististyles laterally in apical third, margins evenly rounded from base to apical third, gradually attenuated to long posterior median blunt point, white pilose except for lateral membranous areas, terminal hairs extending well beyond blunt point. Terminalia: Interior. Hemitergites with dorsal margin evenly rounded at apex, continuing internally and basally as margin of locking fold, margin of locking fold slightly upturned medially, not extending to or below ventral hemitergite margin, attached to hemitergite surface at about middle in apical third, subapical subdorsal hemitergite margin with sparse black pile, tuberculate area moderately large, extending from basal attachment of locking fold diagonally upward and anteriorly almost to dorsal hemitergite margin, few widely scattered tubercles posterior to main area; proctiger narrow dorsally, widest postmedially, margins slightly constricted basally, narrowly expanded into membranous area, strongly constricted anteriorly almost to lateral winglike projec-



MAP 13. Distributions of *Apiocera* sp.: *A. powelli*, *painteri*, *parahydra*, *mortensoni*, *trimaculata*, *ammophila ammophila*, *ammophila hurdi*.

tions, lateral projections prominent, extending outward at right angles to proctiger, downward and slightly anteriorly toward rounded bottom, surface thin, edges even and sharp, upper margins gradually converging posteriorly with rounded tubelike proctiger, sharply pointed ventral projections from apex of proctiger extending downward on each side of aedeagus; claspettes straight, slightly convergent apically, apices turned downward, evenly rounded posteriorly, inner upper margin sparsely golden pilose from near base to near apex, subapical ventral lobes long, curved downward and inward to aedeagus, wide at base, narrowing apically to sharp point, surface sparsely short golden pilose; inner interbasal fold deeply emarginate apically in margin, inner surface at apex sparsely golden pilose, outer interbasal fold slightly expanded apically, ventral sharp angles narrowly extending into ventral opening between dististyles. Length 19.2 mm.; mesonotal width 4.4 mm.

FEMALE: Similar to the male except in the usual secondary sexual characteristics and its larger size. The head is tan pruinose and primarily brown pilose, the mesonotum is tan, gray, and brown pruinose and is lighter in color than the male. The legs are uniform-

ly light reddish and except for the tarsi are sparsely tan pruinose, white pilose and macrochaetose. Tarsi black and white pilose, black macrochaetose. Tarsal pulvilli small, rounded about half as long as claws. The first abdominal segment reddish laterally, second and third segments with dorsolateral rounded median dark spots, middorsal irregular longitudinal dark line on segment two and elongate lateral dark areas above pleural suture and in middle of second and third segments, segment four with basal middorsal dark area. Length 22.1 mm.; mesonotal width 5.1 mm.

TYPE MATERIAL: Holotype male, allotype female, 40 male and five female paratopotypes collected at Ligurta, Yuma County, Arizona, 1980 feet elevation, April 9, 1966 by J. H. and J. M. Davidson and M. Cazier. Seven male and eight female paratypes collected at San Luis, Yuma County, Arizona, April 9, 1966 by J. H. and J. M. Davidson and M. Cazier. Four male, one female paratypes collected 5 miles east of Tacna, Yuma County, Arizona, April 17, 1965 by F. D. Parker.

Holotype male, allotype female and paratopotypes in the collection of the American Museum of Natural History, New York. Paratopotypes and paratypes in the collection of Arizona State University, Tempe.

ETYMOLOGY: From the Greek *ammo*, meaning sand, and *phila*, meaning loving which describes the habitat preference of the species.

ECOLOGY: The type locality was a small sand deposit between tamarisk thickets about 100 yards from an irrigation canal. One end of the sand area showed signs of being flooded, but no flies were found there, preferring rather the dry sand and dense shade afforded by the *Tamarix chinensis* and arrow-weed, *Pluchea sericea*. At San Luis they were taken in a dry sandy area on an elevated, open, flat bench back away from the Colorado River where the vegetative cover was almost exclusively creosote-bush, *Larrea tridentata*. The area was being made ready for a real estate development.

VARIABILITY: In the series of 51 males and 15 females, of which 16 males had their ter-

minalia opened, comparatively little individual or geographical variability was found in any major characteristics. In the males two specimens had the terminalia white pilose except for the tips of the dististyles, and in one specimen the hemitergites and upper margin of the dististyles were black pilose. The anterior tibiae in six specimens were bicolored and the posterior tibial macrochaetae vary from being all white to being predominantly black. In two specimens the marginal mesonotal macrochaetae were all black and, in other specimens, varied to being nearly all white. In one specimen the dorsal dark marking on segment four was not expanded along the apical margin. In the females the dorsolateral dark markings on segment two varied from being rounded to being triangular. Some of the females from San Luis were lighter in color than those from the type locality, being light tan pruinose throughout.

RELATIONSHIPS: *Apiocera ammophila ammophila* and its subspecies *ammophila hurdi* appear to be most closely related to *trimaculata*, but can be separated from it by their dorsally connected dark abdominal markings (fig. 109) and black macrochaetae on the lateral pronotal angles. From *caloris* (map 10), which occurs both east and south of the type locality, *ammophila ammophila* (map 13) can be distinguished by its smaller size, more widely separated compound eyes, by its evenly rounded lateral margins of the median projection of the ninth abdominal sternite and the collar-like subapical portion of the proctiger. It appears to be allopatric with all other species at the present time.

**63. *Apiocera ammophila hurdi*,
new subspecies**

Figure 112; Map 13

DIAGNOSIS: Small-sized, narrow; pteropleura with sparse tuft of long white hair anterior to metathoracic spiracles; dorsocaudal angle of mesopleura with one or two white or black macrochaetae in addition to long tan or white hair; median projection of ninth sternite not extending posteriorly to transverse portions of interbasal folds, overlap-

ping dististyles laterally in median third; hind tibiae predominantly white macrochaetose; median projection of ninth sternite gradually converging posteriorly to median point; abdominal segments two through four with middorsal dark transverse uninterrupted bands expanded medially (fig. 112); mesonotum gray or tan pruinose except for brown pruinose markings; abdominal segments one and two tan white or brown pilose dorsally, segment one with apical submarginal setae brown or black; compound eyes separated from lateral ocelli on vertex by more than the width of a lateral ocellus; terminalia white or gray pruinose in large part, dististyles brown pilose; ocelli on vertex separated from each other by more than the width of a lateral ocellus; pile on costal wing vein white for at least the basal half of wing.

DESCRIPTION: Male: Similar to *ammophila ammophila* in most characteristics, types and extent of variability. *Apiocera ammophila hurdi* can, however, be separated by its disjunct distributional pattern (map 13), smaller average size, and by its primarily or entirely brown or black pilose dististyles and median projection of the ninth sternite. In most specimens the brown pile on the head is more extensive and extends farther down the front of the head. In one specimen the marginal mesonotal macrochaetae are primarily black and abdominal segments one through four are brown pilose dorsally. Two specimens from the type locality have the dististyles and median projection of the ninth sternite white pilose but the remainder are primarily or entirely black pilose. The dorsal dark transverse abdominal vitta on segment four, and occasionally segment three, is narrowly or widely connected to the pleural dark spot (fig. 112). These are separated in *ammophila ammophila* (fig. 109). Length 16.1 mm.; mesonotal width 3.8 mm.

FEMALE: Similar to those specimens from the type locality and the lighter colored specimens from San Luis except of a smaller average size. Length 18.2 mm.; mesonotal width 4.0 mm.

TYPE MATERIAL: Holotype male, allotype female, mounted on the same pin, collected at Borrego, San Diego County, California,

April 25, 1955 by P. D. Hurd. One female paratopotype collected April 26, 1954 by J. G. Rozen. Four male paratopotypes collected April 18, 1957; April 27, 1955; May 1, 1952 by H. R. Moffitt, M. Wasbauer, and G. A. Marsh.

PARATYPES: California: San Diego County: Borrego Valley, April 18, 20, 1957, H. R. Moffitt, R. C. Bechtel, R. W. Bushing, R. M. Bohart, E. I. Schlinger, J. C. Hall, 24 males, 13 females; Palm Canyon, Borrego Valley, April 19, 1957, R. M. Bohart, three males. Imperial County: Yuhu Plain, April 17, 1941, J. Wilcox, one male, one female.

Holotype male, allotype female deposited in the collection of the California Academy of Sciences, San Francisco, on an indefinite loan from the Essig Museum of Entomology, University of California, Berkeley. Paratopotypes and paratypes deposited in the collections of the American Museum of Natural History, New York; the University of California, Berkeley and Davis; Joe Wilcox, Anaheim, California; Arizona State University, Tempe.

ETYMOLOGY: The subspecies is named after Dr. Paul D. Hurd, Curator, Department of Entomology, National Museum of Natural History, Washington, D.C., whose collecting efforts contributed materially to this and other projects, for which I am greatly indebted.

ECOLOGY: The labels on the paratypes collected in Borrego Valley, April 18 and 20 bear the word "dunes," thus indicating a sandy habitat which is present in many areas in Borrego Valley. The three specimens from Palm Canyon may have been taken in the vicinity of the palm grove and, if so, were near water and in abundant shade. Also, this puts *ammophila hurdi* in sympatry with *pearcei* (map 10), *volucra* (map 3), *spectabilis* (map 10), and *alleni* (map 12) in this location. However, they appear to be seasonally allopatric as *ammophila hurdi* occurs from mid April to May 1, whereas the other three are known only from June 5, a month later.

VARIABILITY AND RELATIONSHIPS: These data have been given in the descriptions of both *ammophila ammophila* and *ammophila*

hurdi. The four species given above are only distantly related. *Apiocera volucra* is the only one having the long recumbent pile on the posterior projection of the ninth sternite and the inner margins of the dististyles are apposed in the apical third (see fig. 14). *Apiocera alleni* is the only one with the long thin hairy median projection of the ninth sternite (fig. 23). *Apiocera spectabilis* is much larger than *ammophila hurdi*, it has a narrow subapical dorsal collar on the proc-tiger (fig. 66) and its compound eyes are separated from the lateral ocelli on the vertex by less than half the diameter of a lateral ocellus. From *pearcei*, it can be separated by having its compound eyes separated from the lateral ocelli on vertex by one and one-half times the diameter of a lateral ocellus instead of by about the diameter, and by its primarily white pilose costal wing vein instead of having white pile on the base only.

64. *Apiocera trimaculata* Painter

Figure 108; Map 13

Apiocera trimaculata Painter, 1936, pp. 195–196.

DIAGNOSIS: Male: Small to medium-sized, narrow; pteropleura with sparse long white hairs anterior to the metathoracic spiracles; dorsocaudal angle of mesopleura with or without macrochaetae in addition to hair; posterior femora and tibiae white pilose and macrochaetose; compound eyes separated from lateral ocelli on vertex by about the width of a lateral ocellus; abdomen white or gray pruinose, segments two through four white pilose, with dark dorsal markings, usually triangular or subtriangular on segments two through four, or larger on segments three and four (fig. 108); median projection of ninth sternite flat, not extending posteriorly beyond transverse portions of interbasal folds, membranous or parchment-like lateral projections overlapping dististyles laterally for about middle third, without long recumbent pile, not biemarginate apically; inner dististyle margins without postmedian incisions, margins not apposed ventrally from apex of median projection of the ninth sternite to near apex, gradually curved inward subapically, white pilose externally;

hemitergites gray pruinose, white pilose externally; mesonotal marginal macrochaetae primarily white; femora and tibiae unicolorous black or piceous. Terminalia: Interior. Claspettes not arcuate dorsoventrally; proctiger without sickle-shaped horizontal posterior blades, not cleft medially at dorsal apex, without elongate dorsal collar; inner interbasal folds with dorsal margin deeply emarginate apically.

FEMALE: Abdominal dorsolateral dark maculations absent or in dull brown pruinose spots; posterior tarsal pulvilli about half as long as claws; pteropleura with sparse long white hairs; costal wing vein white pilose; abdominal sternites one through five white pilose; posterior tibiae white macrochaetose; lateral pronotal angles white macrochaetose; abdominal segment one with lateral submarginal macrochaetae white.

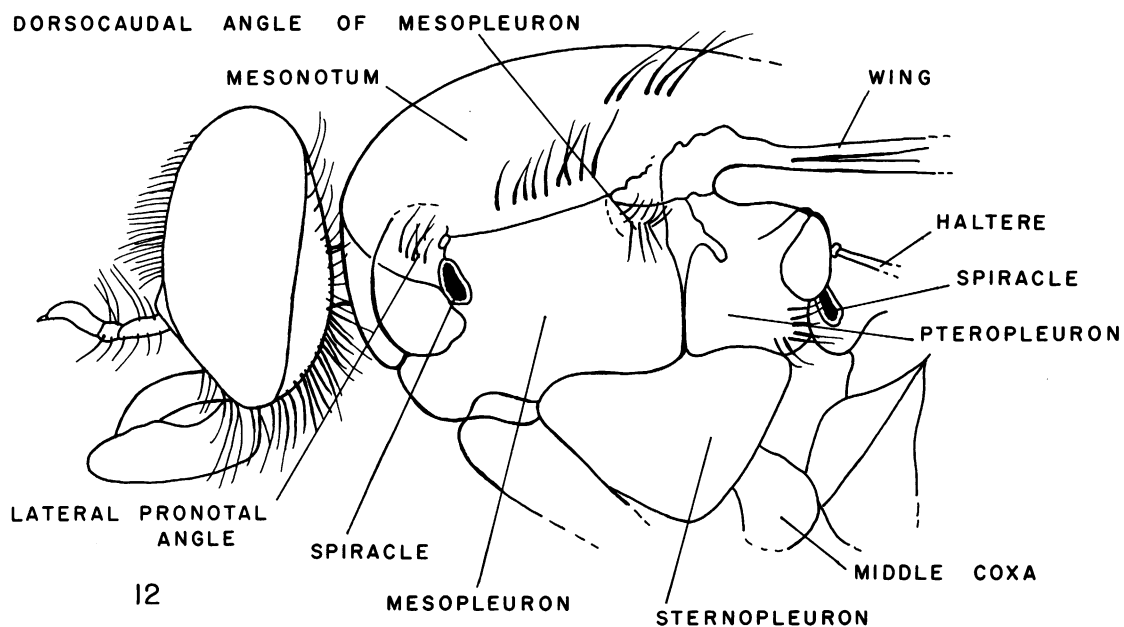
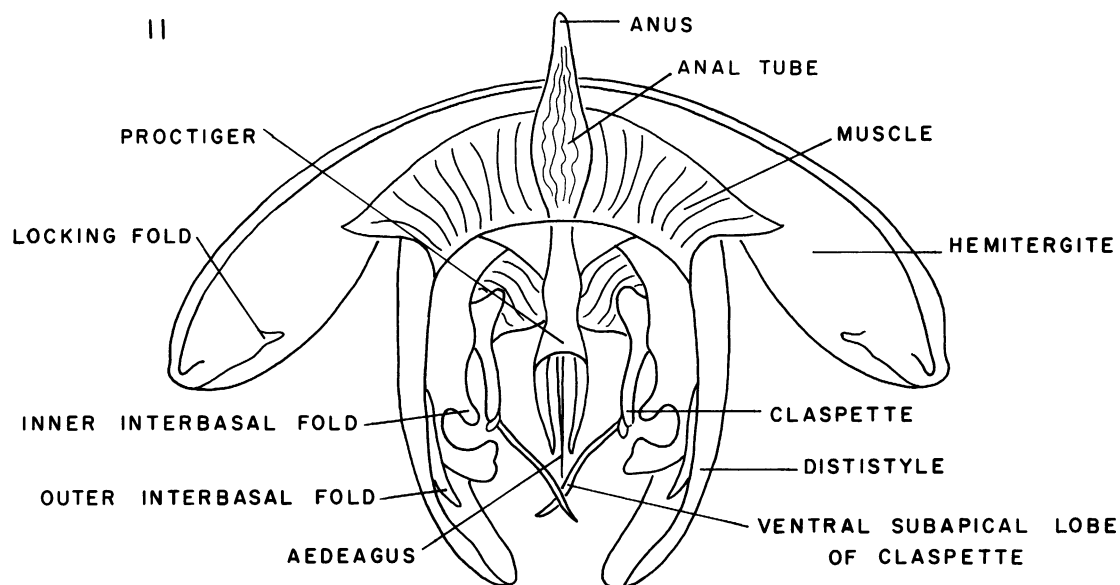
TYPE LOCALITY: San Diego County, California, D. W. Coquillett. Holotype male in the National Museum of Natural History, Washington, D.C., catalogue number 51435.

DISTRIBUTION: California: Riverside County: 6 miles west Indio, April 30, 1949, E. G. Linsley, J. W. MacSwain, R. F. Smith; Indio, April 22, 1941, J. Wilcox.

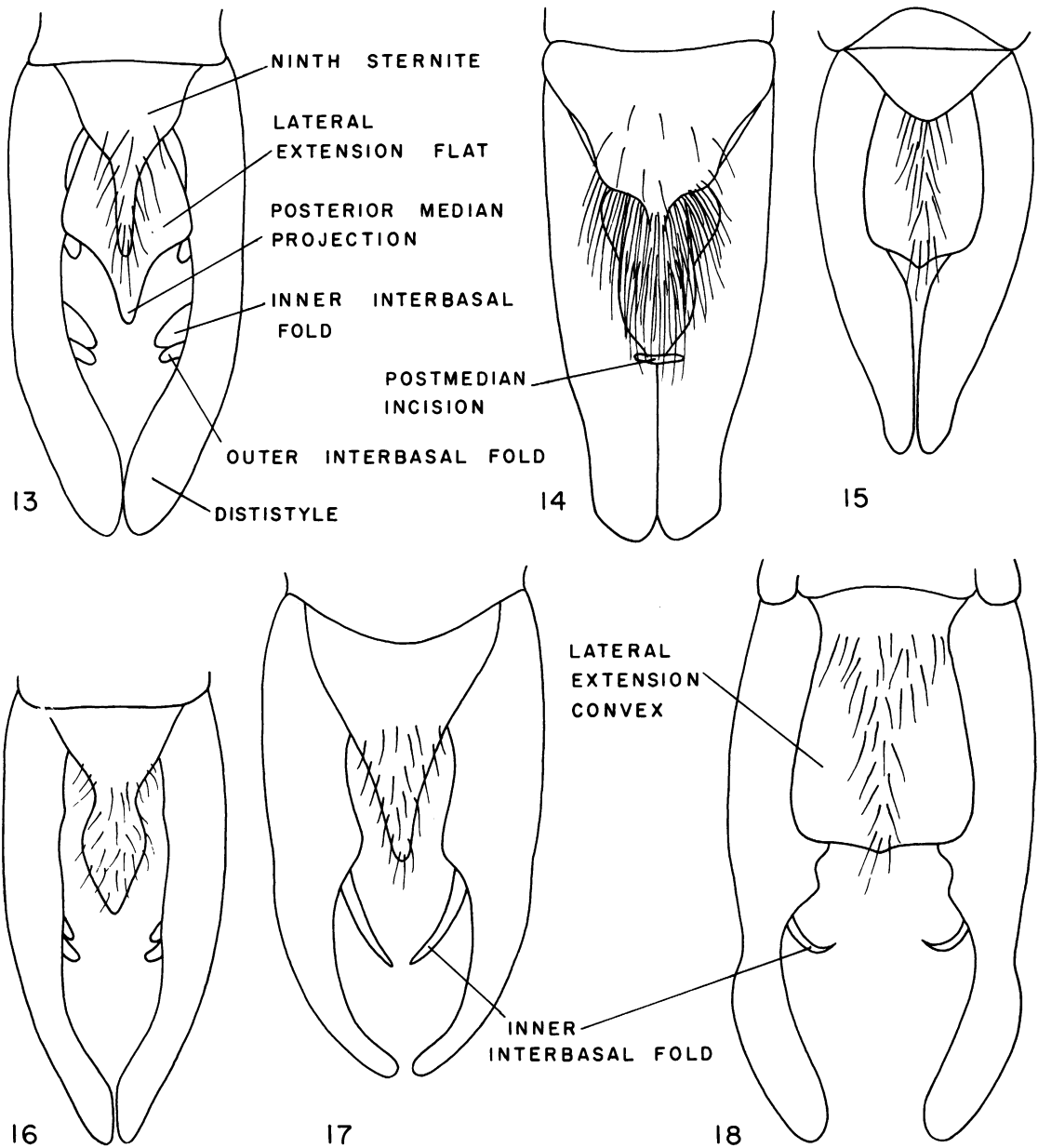
ECOLOGY: Specimens from 6 miles west of Indio were taken on *Melilotus* species, sweet clover, but since neither the males nor females had any pollen or sign of nectar on their mouthparts, they may have been sitting in the shade of the clover rather than feeding. Specimens collected at two miles south of Indio were found in a grape vineyard.

RELATIONSHIPS: *Apiocera trimaculata* ap-

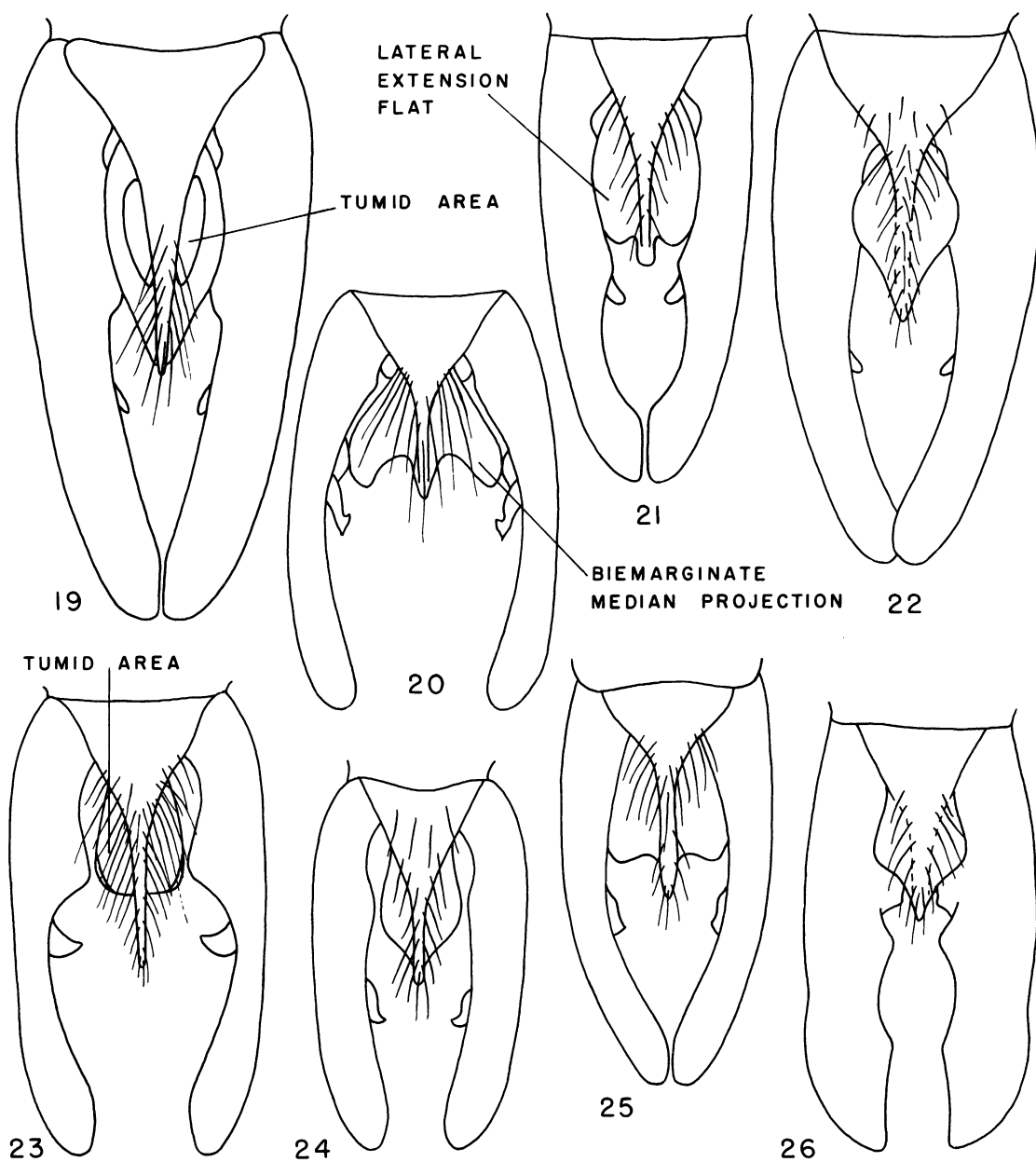
pears to be most closely related to *A. ammophila ammophila* but can be separated by its unicolorous black or piceous legs and by not having a collar near the dorsal apex of the proctiger. In *ammophila ammophila* and *ammophila hurdi* there is a short collar on the preapex of the proctiger and the legs are bicolorous, the femora black or piceous, and the tibiae testaceous or light reddish brown. *Apiocera trimaculata* (map 13) occurs in Riverside County, California, northwest of Salton Sea and in San Diego County, whereas *ammophila ammophila* (map 13) is found only in southeastern Yuma County, Arizona. *Apiocera ammophila hurdi* (map 13) occurs in Borrego Valley in San Diego County and Yuhu Plain in Imperial County and can be distinguished from *trimaculata* by having the terminalia white pilose instead of black or brown, by having the dark maculation on abdominal segment two in the form of a wide transverse median vitta instead of a median dark spot (fig. 112) and by its bicolored legs as given above for *ammophila ammophila*. *Apiocera trimaculata* (map 13) is geographically sympatric with *interrupta* (map 6) and *A. aldrichi* (map 9) at Indio, but the three species are only distantly related. See the discussions under *interrupta* and *aldrichi* for comparisons. For rapid differentiation, *interrupta* has dorsolateral longitudinal narrow abdominal maculations; *aldrichi* has wide transverse dark abdominal vittae and segments three and four are black pilose dorsally; *trimaculata* has median dorsal dark spots on abdominal segments two through four and the pile is white (fig. 108).



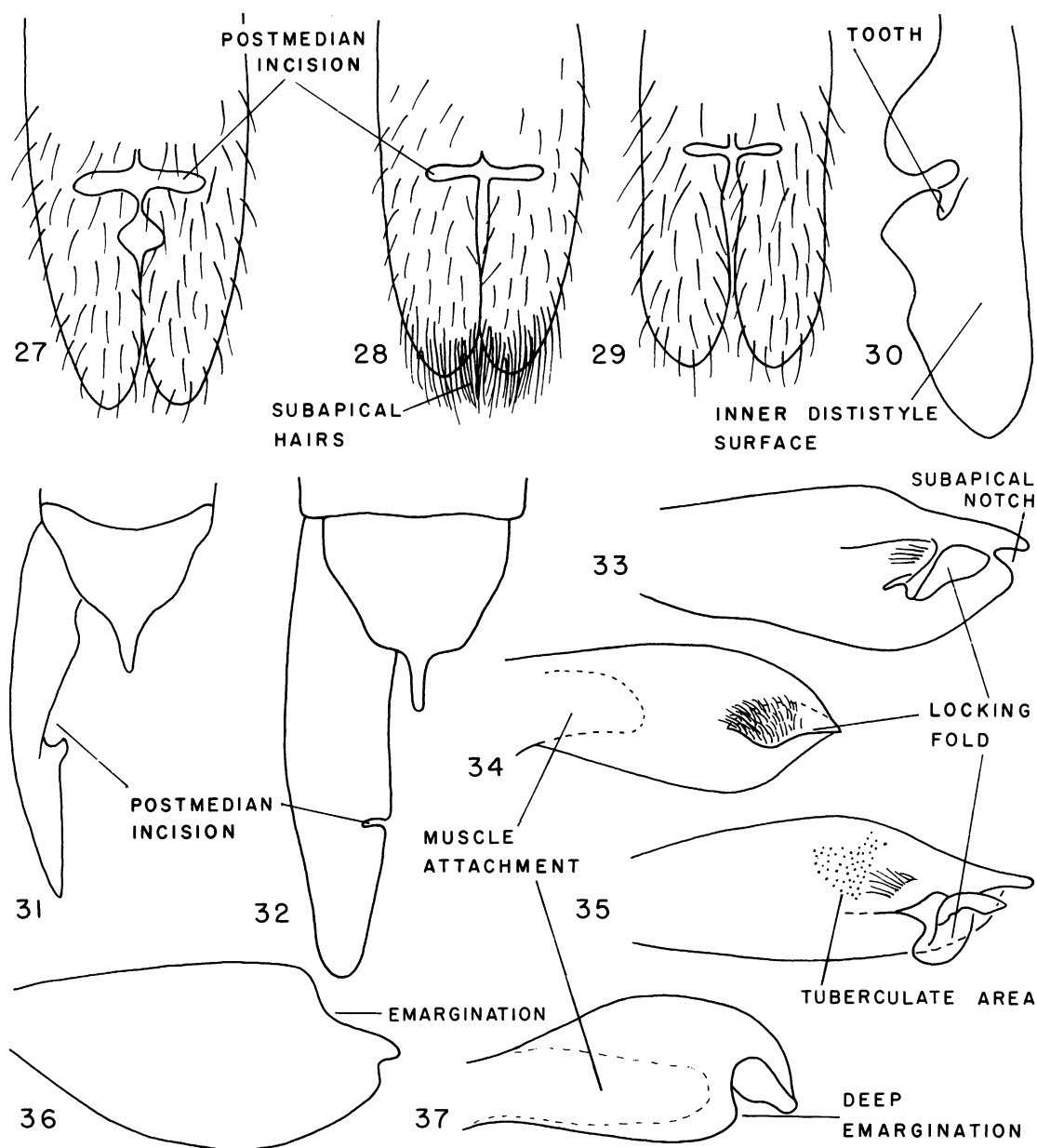
FIGS. 11-12. *Apiocera spectabilis*. 11. Terminalia, dorsal interior view. 12. Head and thorax, lateral view.



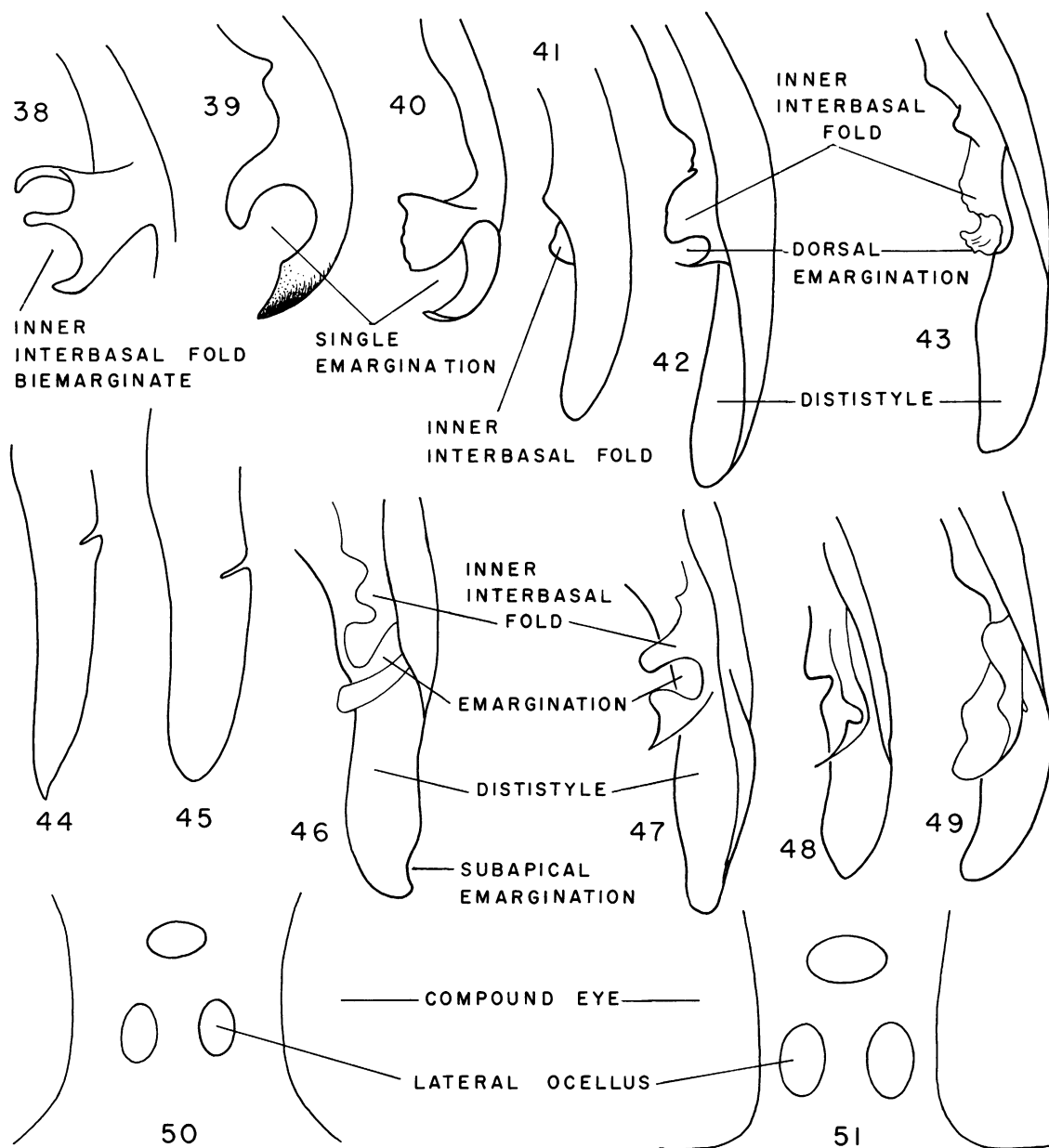
FIGS. 13-18. Male terminalia, ventral view. 13. *Apiocera spectabilis*. 14. *A. haruspex haruspex*. 15. *A. bigelowi*. 16. *A. aldrichi*. 17. *A. clavator*. 18. *A. hamata*.



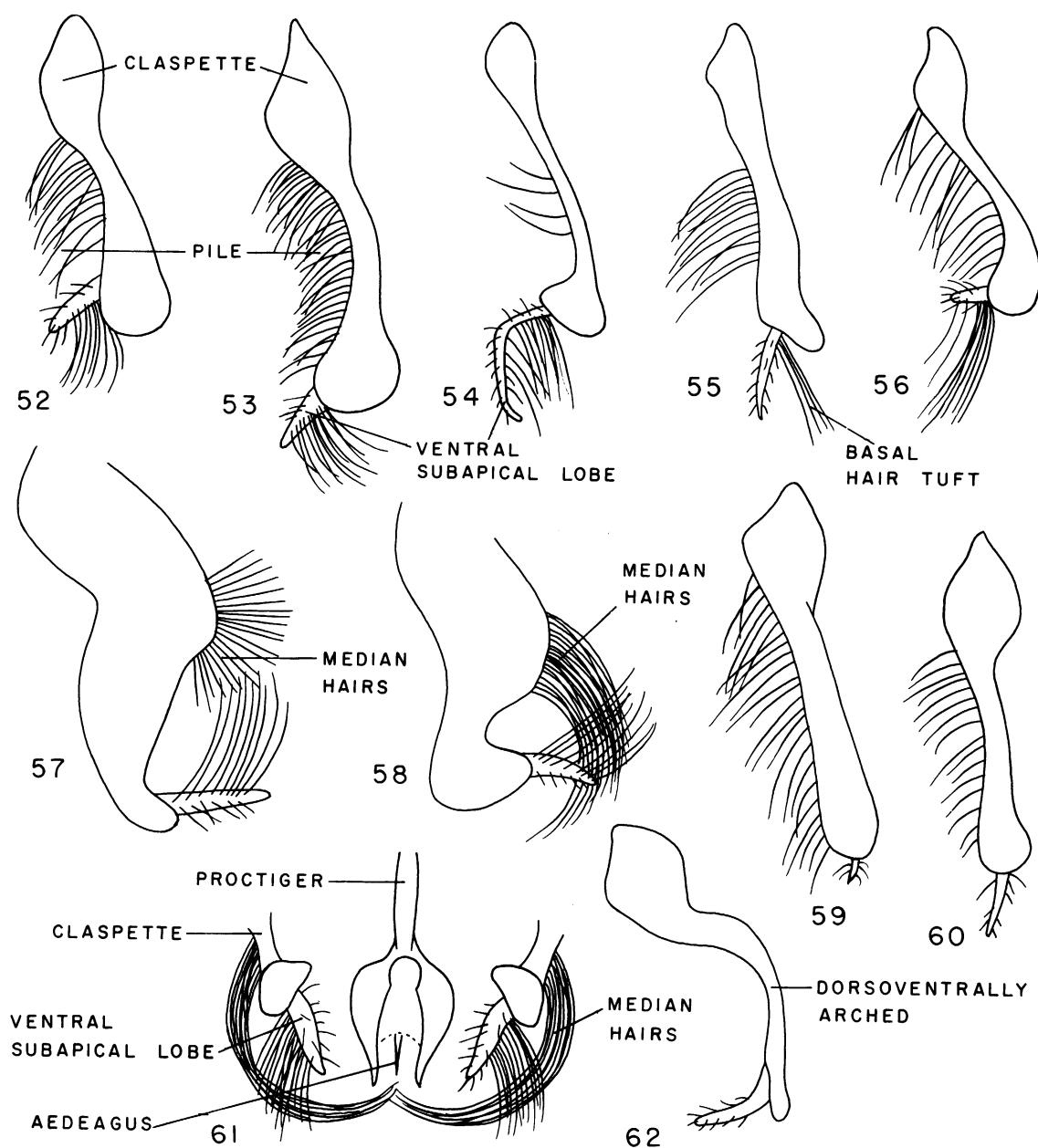
FIGS. 19-26. Male terminalia, ventral view. 19. *Apiocera pruinosa*. 20. *A. powelli*. 21. *A. caloris*. 22. *A. parkeri*. 23. *A. alleni*. 24. *A. auripilosa*. 25. *A. calida*. 26. *A. linsleyi* linsleyi.



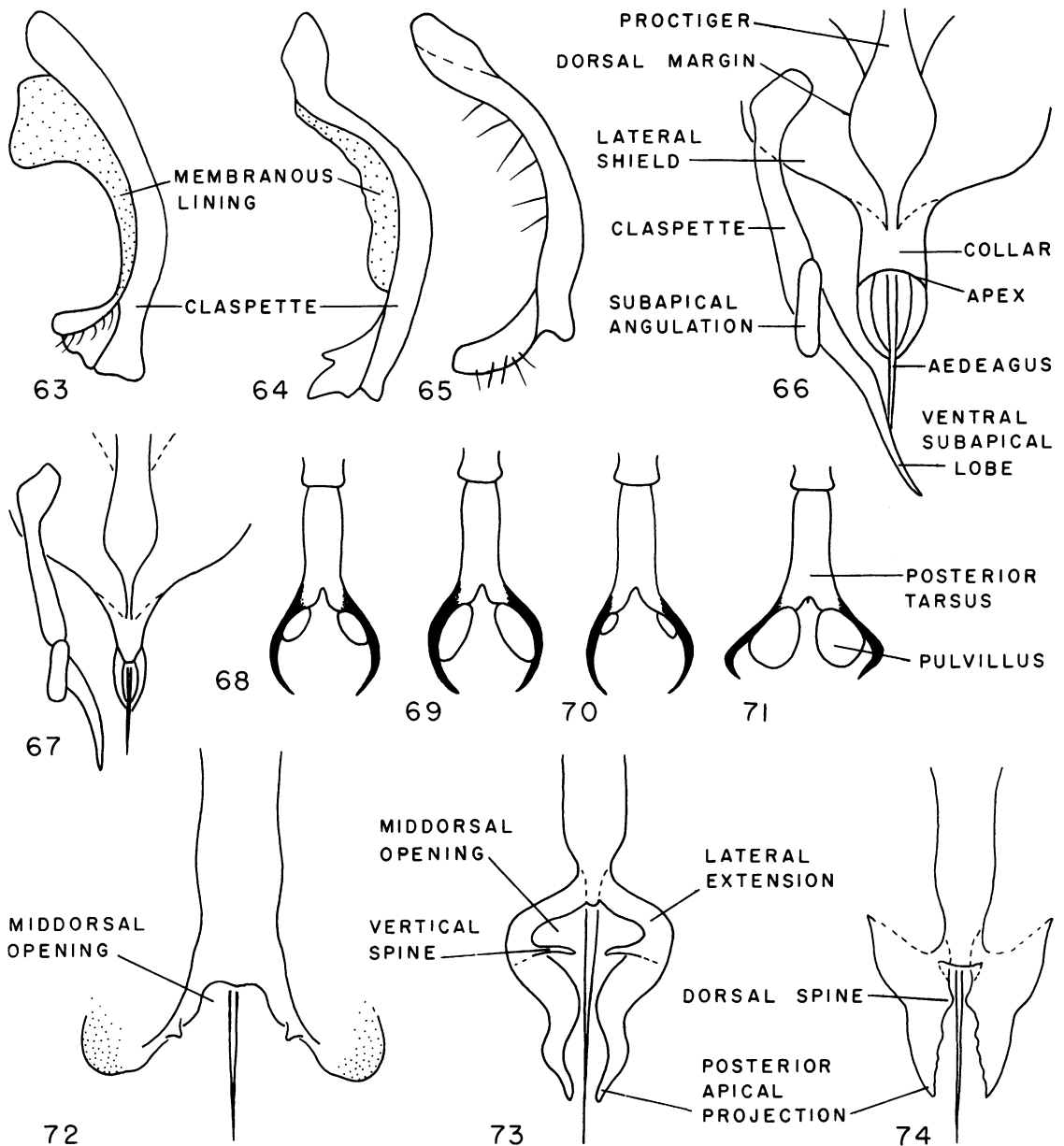
FIGS. 27-37. Male terminalia structures. 27-29. Ventral view. 27. *Apiocera melanura*. 28. *A. mexicana*. 29. *A. infinita*. 30. Inner dististyle surface, *A. rubrifasciata*. 31-32. Outer dististyle surface. 31. *A. wilcoxi*. 32. *A. haruspex haruspex*. 33-37. Inner hemitergite surface. 33. *A. haruspex haruspex*. 34. *A. sonora*. 35. *A. barri*. 36. *A. aldrichi*. 37. *A. clavator*.



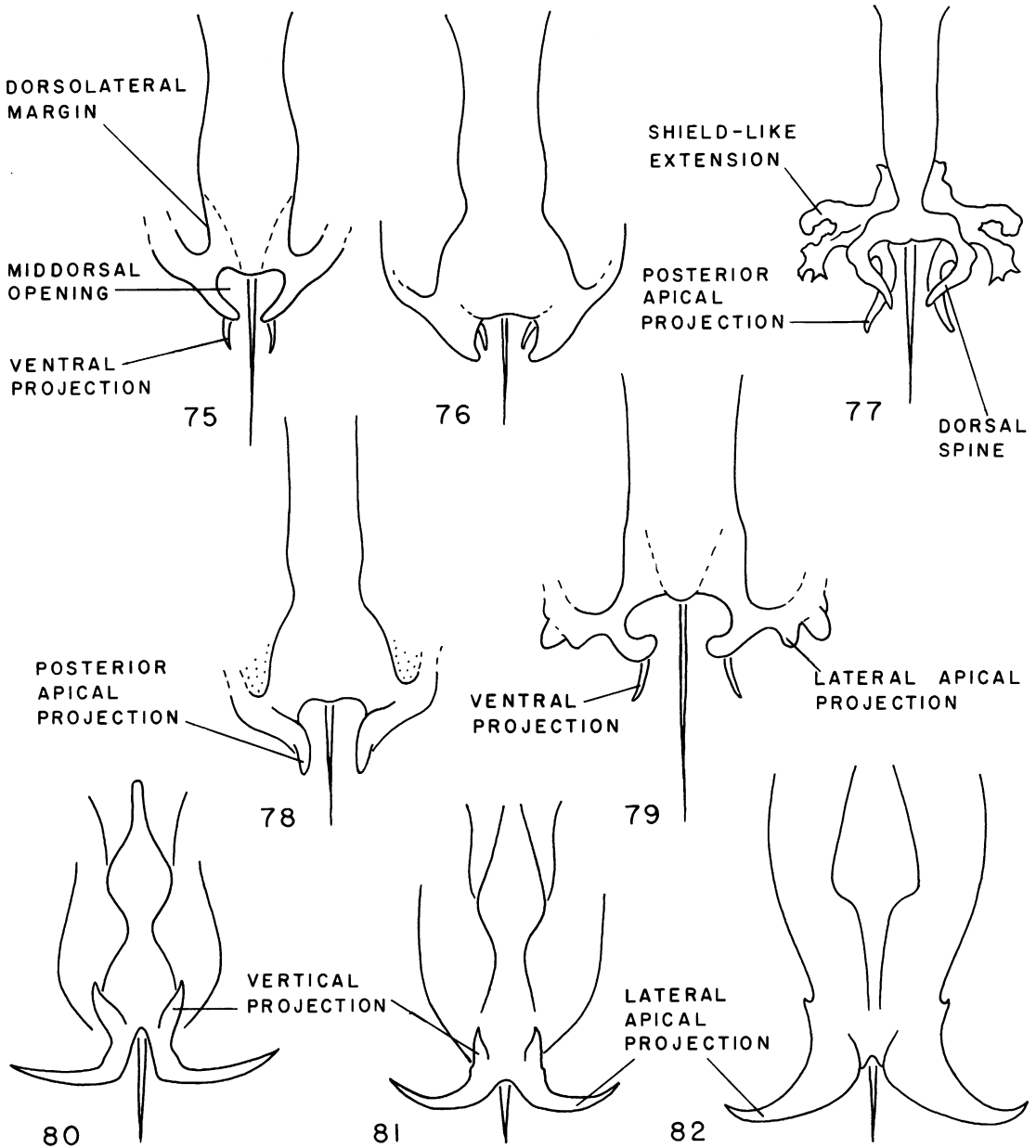
FIGS. 38-51. Male terminalia structures, vertex of head showing ocelli. 38-43. Inner interbasal folds. 38. *Apiocera haruspex haruspex*. 39. *A. spectabilis*. 40. *A. sonora*. 41. *A. chiltonae*. 42. *A. pearcei*. 43. *A. calida*. 44-45. Ventral view dististyle surface. 44. *A. acuticauda*. 45. *A. haruspex haruspex*. 46-49. Inner interbasal folds, inner dististyle surfaces. 46. *A. augur*. 47. *A. fisheri*. 48. *A. linsleyi linsleyi*. 49. *A. chiltonae*. 50-51. Head, vertex. 50. *A. hispida*. 51. *A. beameri*.



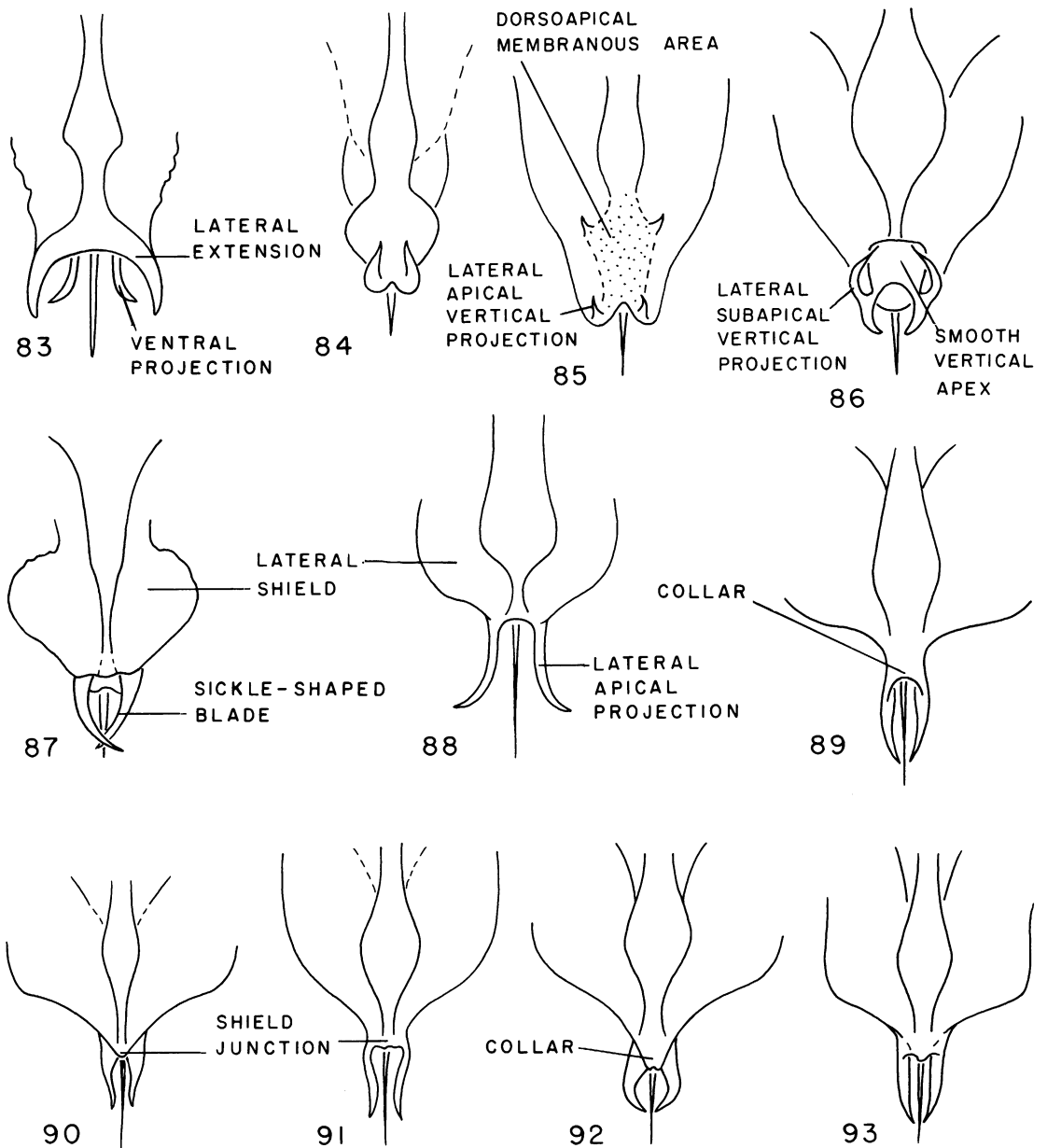
FIGS. 52-62. Male terminalia, claspettes, ventral subapical lobes of claspettes and one posterior-dorsal view of proctiger and claspettes. Dorsal view of claspettes and ventral subapical lobes. Fig. 52. *Apiocera sylvestris*. 53. *A. haruspex haruspex*. 54. *A. wilcoxi*. 55. *A. barri*. 56. *A. horticolis*. Lateral view of claspettes and ventral subapical lobes. 57. *A. haruspex haruspex*. 58. *A. notata*. Dorsal view of claspettes and ventral subapical lobes. 59. *A. intonsa*. 60. *A. interrupta*. Posterior-dorsal view of proctiger, claspettes and ventral subapical lobes. 61. *A. notata*. Lateral view of claspette and ventral subapical lobe. 62. *A. hamata*.



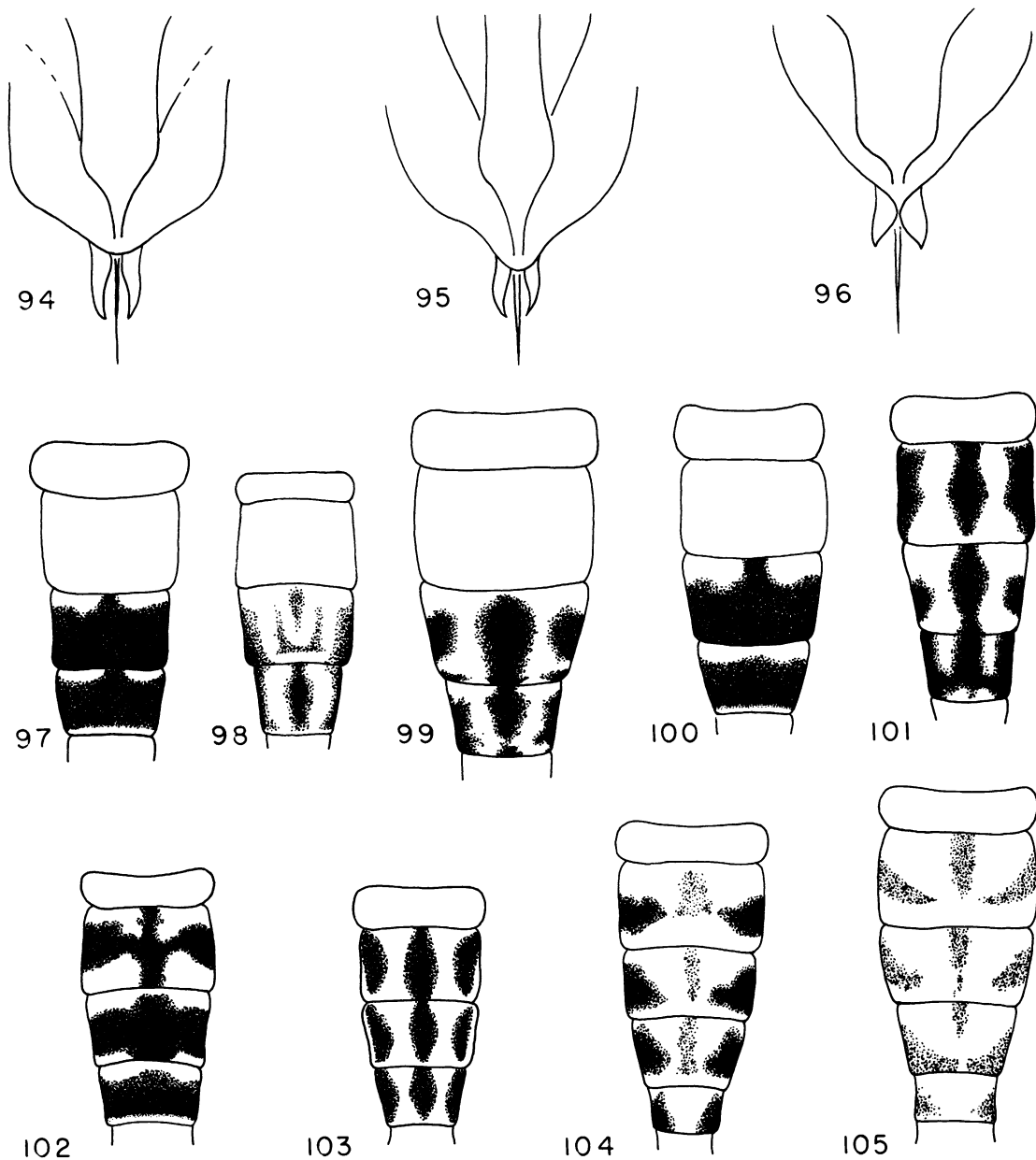
FIGS. 63-74. Male terminalia, claspettes, proctigers. Posterior tarsal pulvilli. 63-65. Claspettes. 63. *Apiocera augur*. 64. *A. chiltonae*. 65. *A. bigelowi*. 66-67. Claspettes and proctigers. 66. *A. spectabilis*. 67. *A. voragocolis*. 68-71. Posterior tarsal pulvilli. 68. *A. sonora*. 69. *A. rubrifasciata*. 70. *A. bilineata*. 71. *A. infinita*. 72-74. Proctigers. 72. *A. foleyi*. 73. *A. haruspex haruspex*. 74. *A. parahydra*.



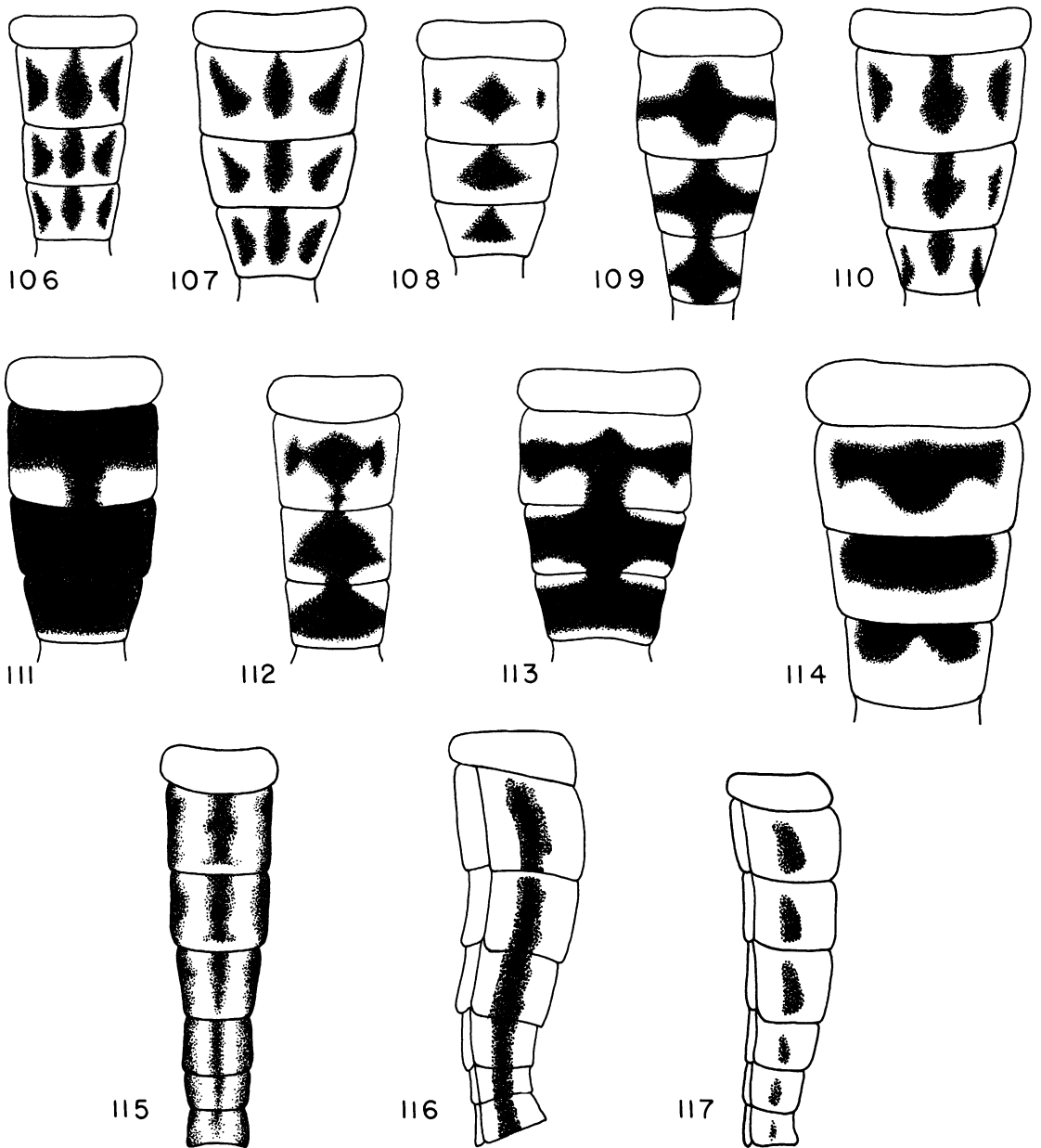
FIGS. 75–82. Male terminalia, proctigers. 75. *Apiocera bibula*. 76. *A. volucra*. 77. *A. fallax*. 78. *A. horticolis*. 79. *A. chrysolasia*. 80. *A. minckleyi*. 81. *A. frankei*. 82. *A. hamata*.



FIGS. 83-93. Male terminalia, proctigers. 83. *Apiocera bigelowi*. 84. *A. femoralis*. 85. *A. linsleyi*. 86. *A. chiltonae*. 87. *A. aldrichi*. 88. *A. powelli*. 89. *A. calor*. 90. *A. arena*. 91. *A. exta*. 92. *A. davidsonorum*. 93. *A. parkeri*.



FIGS. 94–105. Male terminalia, proctigera. Male abdominal maculations. 94–96. Proctigera. 94. *Apiocera canuta*. 95. *A. pruinosa*. 96. *A. caboae*. 97–105. Male abdominal maculations. 97. *A. notata*. 98. *A. convergens*. 99. *A. bibula*. 100. *A. volucra*. 101. *A. haruspex martinorum*. 102. *A. haruspex atrifasciata*. 103. *A. painteri*. 104. *A. femoralis*. 105. *A. rockefelleri*.



FIGS. 106-117. Male abdominal maculations. 106. *Apiocera linsleyi linsleyi*. 107. *A. linsleyi obliqua*. 108. *A. trimaculata*. 109. *A. ammophila ammophila*. 110. *A. davidsonorum*. 111. *A. parkeri*. 112. *A. ammophila hurdi*. 113. *A. beameri*. 114. *A. hispida*. 115. *A. mexicana*. 116. *A. infinita*. 117. *A. melanura*.

APPENDIX 1

For convenience, primarily in facilitating the identification of the females, the species and subspecies as well as the countries, states and counties are listed alphabetically. These will be of special value in conjunction with the female key where a number of species may appear in a single couplet of a dichotomy. Additional distributional information is included in the text under each species.

Apiocera acuticauda, new species

United States. California: Riverside, San Bernardino counties.

Apiocera aldrichi Painter

Mexico. Sonora. United States. Arizona: Maricopa, Mohave, Pinal, Yuma counties. California: Imperial, Riverside, San Bernardino, San Diego counties, Nevada: Lincoln County.

Apiocera alleni Cazier

United States. California: San Bernardino, San Diego counties.

Apiocera ammophila ammophila, new subspecies

United States. Arizona: Yuma County.

Apiocera ammophila hurdi, new subspecies

United States. California: Imperial, San Diego counties.

Apiocera arena, new species

United States. California: Inyo, San Bernardino counties. Nevada: Clark County.

Apiocera arnaudi, new species

Mexico. Baja California Norte.

Apiocera augur Osten Sacken

Mexico. Colima?, Sinaloa

Apiocera auripilosa, new species

United States. Arizona: Apache, Coconino counties. Colorado: Mesa, Montezuma counties.

Apiocera barri, new species

Canada. British Columbia. United States. California: Alameda, Colusa, Contra Costa, Mendocino, Merced, Santa Barbara, Santa Cruz, Siskiyou, Solano, Sonoma, Yolo counties. Idaho: Nez Perce, Idaho counties. Oregon: Gilliam, Umatilla counties. Washington: Asotin, Franklin, Okanogan, Yakima counties.

Apiocera beameri Painter

United States. California: Fresno, Santa Barbara counties.

Apiocera bibula, new species

Mexico. Baja California Sur.

Apiocera bigelowi, new species

Mexico. Coahuila.

Apiocera bilineata Painter

Mexico. Chihuahua. United States. New Mexico: Otero County.

Apiocera caboae, new species

Mexico. Baja California Sur.

Apiocera calida, new species

United States. Arizona: Yuma County.

Apiocera caloris Painter

Mexico. Sonora. Arizona: Yuma County. California: Riverside County.

Apiocera canuta, new species

United States. Arizona: Pinal County.

Apiocera chiltonae, new species

United States. Arizona: Maricopa County.

Apiocera chrysolasia, new species

Mexico. Baja California Norte. United States. California: Contra Costa, Los Angeles, Orange, Riverside, San Diego counties.

Apiocera clavator Painter

Mexico. Colima and/or Jalisco.

Apiocera convergens Painter

United States. California: Riverside, San Bernardino counties.

Apiocera davidsonorum, new species

Mexico. Baja California Sur.

Apiocera draperae, new species

United States. Texas: Brewster County.

Apiocera exta Cazier

United States. California: Inyo County.

Apiocera fallax, new species

United States. California: Fresno, Madera counties.

Apiocera femoralis, new species

Mexico. Chihuahua. United States. Texas: Brewster County.

Apiocera fisheri, new species

Mexico. Baja California Norte.

Apiocera foleyi, new species

United States, California: Kern, Los Angeles, San Bernardino counties.

Apiocera franckei, new species

United States. New Mexico: Dona Ana County. Texas: Brewster, Pecos, Valverde counties.

Apiocera hamata, new species

United States. New Mexico: Sandoval County. Texas: El Paso County.

Apiocera haruspex atrifasciata, new subspecies

United States. California: Inyo, Los Angeles, Mono, San Bernardino counties. Nevada:

- Clark, Lincoln, Lyon, Mineral, Nye, Ormsby counties.
- Apiocera haruspex haruspex* Osten Sacken
United States. California: El Dorado, Fresno, Mariposa, Mono, Nevada, Plumas, Tuolumne counties.
- Apiocera haruspex martinorum* Painter
United States. California: Lassen County. Idaho: Canyon, Cassia, Fremont, Gooding, Lincoln, Owyhee, Twin Falls counties. Nevada: Churchill, Humboldt, Washoe counties. Oregon: Malheur County.
- Apiocera haruspex oncorhachis*, new subspecies
United States. California: Tulare County.
- Apiocera hispida* Cazier
United States. California: Inyo, San Bernardino counties. Nevada: Nye County.
- Apiocera horticolis*, new species
Mexico. Baja California Norte and Sur.
- Apiocera infinita* Cazier
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- Apiocera interrupta* Painter
United States. California: Los Angeles, Riverside, San Diego, Ventura counties.
- Apiocera intonsa* Cazier
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- Apiocera linsleyi linsleyi*, new subspecies
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- Apiocera mortensoni*, new species
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- Apiocera ogradyi*, new species
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- Apiocera painteri* Cazier
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- Apiocera sylvestris*, new species
United States. Arizona: Graham, Mohave, Pima counties.
- Apiocera trimaculata* Painter
United States. California: Riverside, San Diego counties.
- Apiocera volucra*, new species
Mexico. Baja California Norte. United States. California: Riverside, San Bernardino, San Diego counties.
- Apiocera voragocolis*, new species
United States. Arizona: Coconino County.
- Apiocera wilcoxi*, new species
United States. California: Riverside County.

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